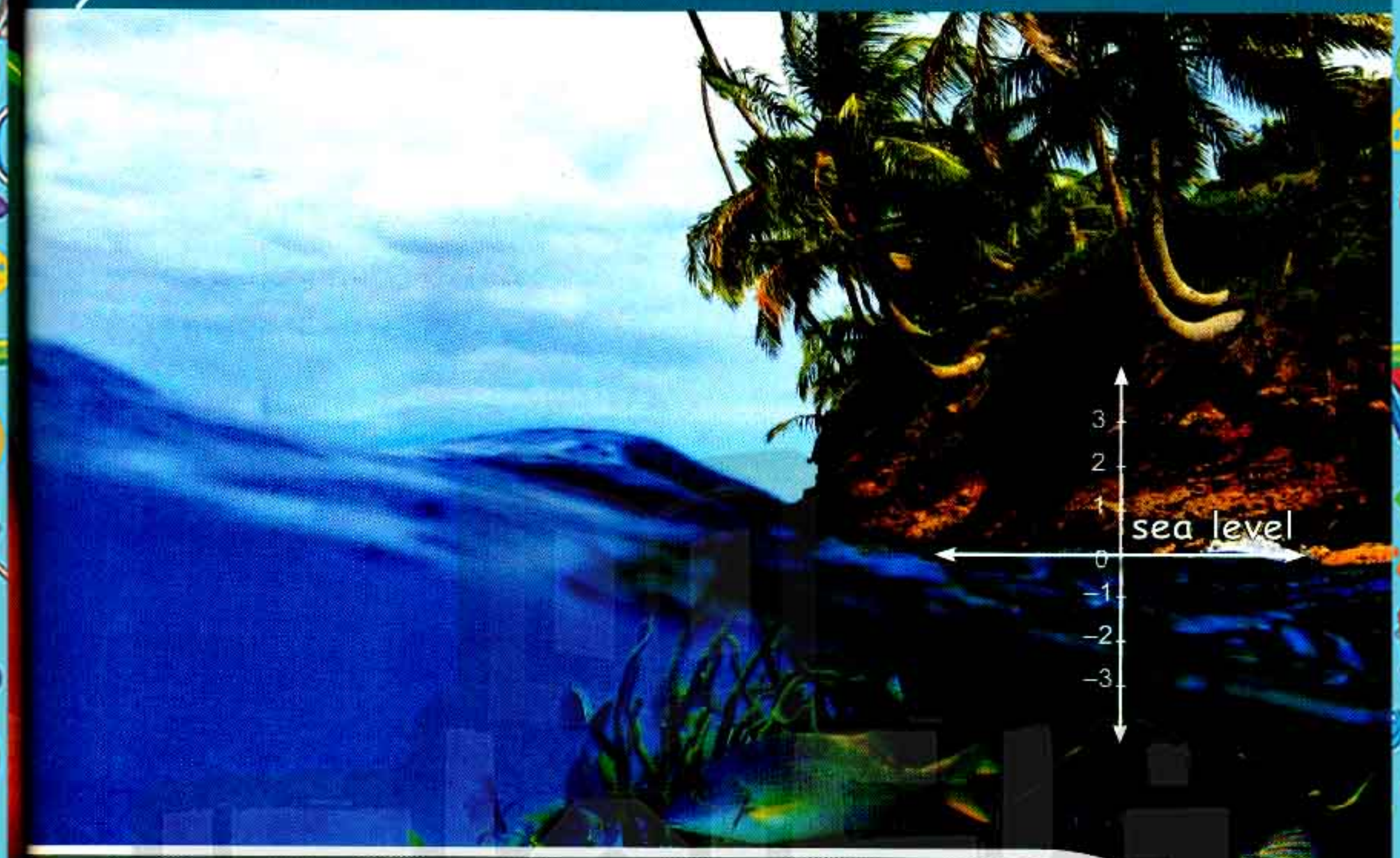


Unit 1

THE INTEGER NUMBERS

- Lesson 1 : The set of integers (ℤ)
- Lesson 2 : Ordering and comparing integers
- Lesson 3 : Adding and subtracting integers
- Lesson 4 : Multiplying and dividing integers
- Lesson 5 : Repeated multiplication
- Lesson 6 : Numerical patterns
- Selected problems from previous exams on Unit (1)
- Test on Unit (1) from the School Book

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1 Lesson

THE SET OF INTEGERS (ℤ)

Aims

At the end of this lesson, you will be able to:

(1) recognise the set of integers (ℤ).

(2) recognise the subsets of ℤ .

(3) reognise the concept of the absolute value.

WARM UP

watch video

- **The teacher said,** "You have studied that"

(1) a) The set of counting numbers: $\mathbb{C} = \{1, 2, 3, \ldots\}$.

b) The set of natural numbers: $\mathbb{N} = \{0, 1, 2, 3, \ldots\}$.

c) The set of prime numbers: $\mathbb{P} = \{2, 3, 5, 7, 11, \ldots\}$.

The prime number has only two factors: 1 and the number itself.

(2) **Note that**

$\mathbb{C} \cup \{0\} = \mathbb{N}$, $\mathbb{C} \subset \mathbb{N}$, $\mathbb{P} \subset \mathbb{N}$



- **A pupil asked,** "What about the set of integer numbers?"

the set of integers	مجموعة الأعداد الصحيحة

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The need for more numbers:

- In our daily life there are many opposite situations which we cannot express by using only the natural numbers as the following:





a) The temperature over the mountain is recorded 5° C below zero, then this is written as -5° C ($-5 \notin \mathbb{N}$).



b) The depth of the ocean at a point is 10 metres below the sea level, then: this is written as –10 m ($-10 \notin \mathbb{N}$).



- Thus, it is very useful to use new numbers as:

$-1, -2, -3, -4, -5, \ldots$ which are called the negative integer numbers $\mathbb{Z}^-$.

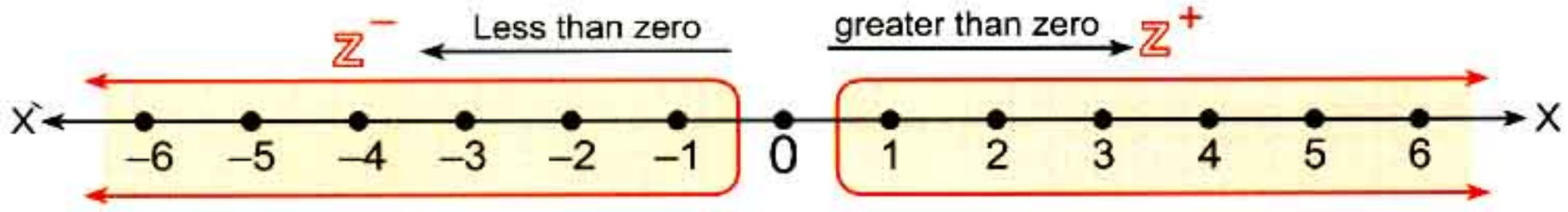
Set of integer numbers (ℤ):

If we combine the negative numbers $\mathbb{Z}^-$ to the set of natural numbers ($\mathbb{N}$), then:

The new set is called the set of integers and it is denoted by ($\mathbb{Z}$).

So, $\mathbb{Z} = \{ \ldots, -4, -3, -2, -1, 0, 1, 2, 3, 4, \ldots \}$.

We can represent the integer numbers ($\mathbb{Z}$) on the number line as follows:



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Solved Example 1

Write an integer to express each situation of the following:

ⓐ The temperature of Moscow is 7 degrees below zero.

ⓑ The stock market had lost 4 million pounds in a day.

ⓒ New records for fish exceeding 6000 m deep.



ⓓ Hany gained L.E. 76 from his saving account.

ⓔ The depth of a pubilc garage in downtown Cairo consists of four underground floors.

ⓕ Paris rises 6 metres above sea level.

ⓖ Ahmed withdrew 6000 pounds from his bank account.

ⓗ Cairo tower is 187 m above ground.

Solution

ⓐ The statement "below zero" indicates that the number 7 is negative (–7).

ⓑ The word "lost" indicates that the amount of 4 million is negative (–4 million).

ⓒ The statement "exceeding 6000 m deep" indicates that 6000 is (–6000).

ⓓ The word "gained" means that the sum 76 is positive.

ⓔ The word "underground" means that the number four is negative (–4).

ⓕ "Above sea level" means that 6 metres is (positive).

ⓖ The word "withdrew" means –6000

ⓗ The word "above" means 187 (positive).

Check Point

Write an integer to represent each situation of the following:

(1) A submarine can descend to a depth of 60 metres

(2) An altitude of 4 572 m

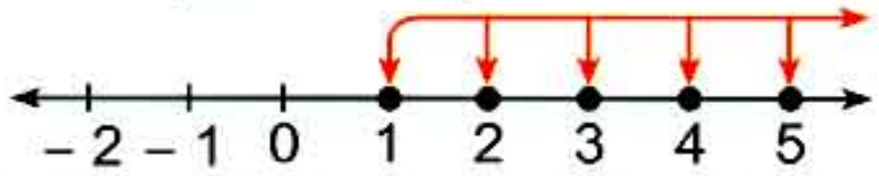
(3) John had 200 pounds. He lost 15 pounds, then gained 35 pounds

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The relation between ℤ, ℤ⁺, ℤ⁻ and ℕ:

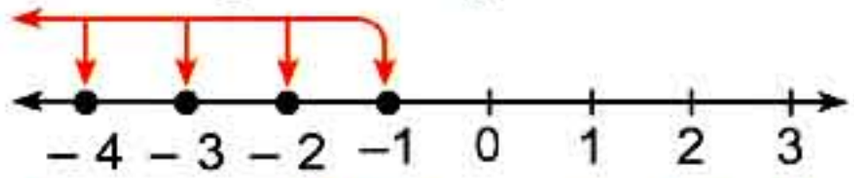
Set of integers(ℤ)

The set of positive integers on number line:



The elements of $\mathbb{Z}^+$ lie on the right of zero.

The set of negative integers on number line:



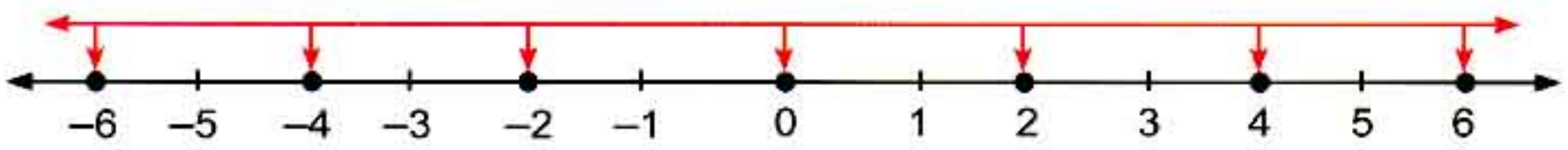
The elements of $\mathbb{Z}^-$ lie on the left of zero.

This means that: $\mathbb{Z} = \mathbb{Z}^+ \cup \{0\} \cup \mathbb{Z}^-$

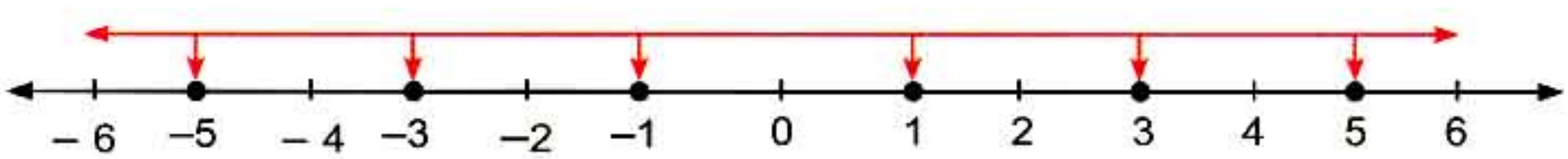
i.e $\mathbb{Z} = \mathbb{N} \cup \mathbb{Z}^-$

Notice that

- The set of positive integers $(\mathbb{Z}^+) = \{1, 2, 3, 4, \dots\} = \mathbb{C}$
- The set of negative integers $(\mathbb{Z}^-) = \{-1, -2, -3, -4, \dots\}$
- Zero is neither positive nor negative i.e $0 \notin \mathbb{Z}^+$ and $0 \notin \mathbb{Z}^-$
- The set of non-negative integers $(\mathbb{Z}^+ \cup \{0\}) = \{0, 1, 2, 3, 4, \dots\} = \mathbb{N}$
- The set of non-positive integers $(\mathbb{Z}^- \cup \{0\}) = \{0, -1, -2, -3, \dots\}$
- The set of even integers = $\{\dots, -4, -2, 0, 2, 4, \dots\}$



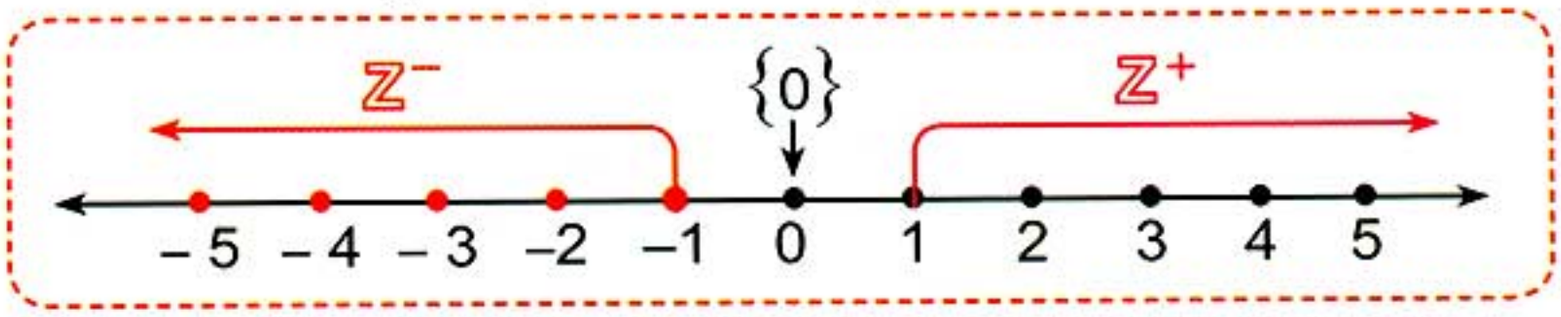
- The set of odd integers = $\{\dots, -5, -3, -1, 1, 3, 5, \dots\}$

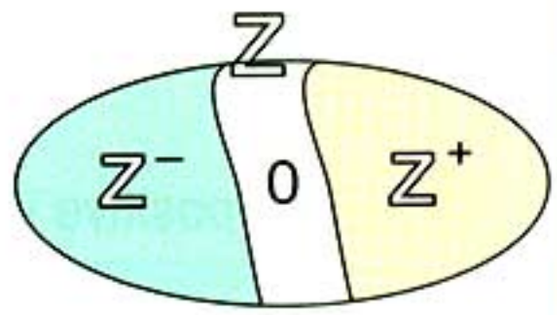


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Solved Example 2

Notice the figure, then complete:





ⓐ $\mathbb{N} = \mathbb{Z}^+ \cup$

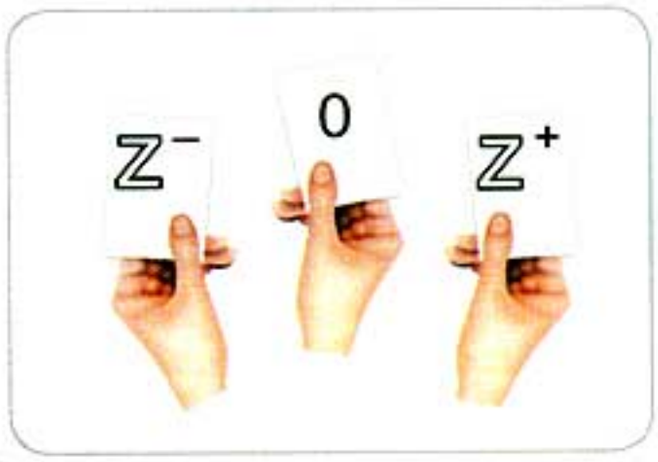
ⓑ $\mathbb{Z} = \mathbb{Z}^+ \cup$ $\cup$

ⓒ $\mathbb{Z}^+ \cap \mathbb{Z}^- =$

ⓓ $\mathbb{Z}^- - \mathbb{Z}^+ =$

ⓔ $\mathbb{Z}^+ - \mathbb{Z}^- =$

ⓕ $\mathbb{Z} - \mathbb{Z}^- =$



ⓖ is the smallest positive integer.

ⓗ is the greatest negative integer.

Solution

ⓐ $\mathbb{N} = \mathbb{Z}^+ \cup \{0\}$

ⓑ $\mathbb{Z} = \mathbb{Z}^- \cup \{0\} \cup \mathbb{Z}^+$

ⓒ $\mathbb{Z}^+ \cap \mathbb{Z}^- = \varnothing$

ⓓ $\mathbb{Z}^- - \mathbb{Z}^+ = \mathbb{Z}^-$

ⓔ $\mathbb{Z}^+ - \mathbb{Z}^- = \mathbb{Z}^+$

ⓕ $\mathbb{Z} - \mathbb{Z}^- = \mathbb{N}$

ⓖ 1

ⓗ −1

Solved Example 3

Complete using the suitable sign ($\in$, $\notin$, $\subset$, $\not\subset$):

ⓐ -5 $\mathbb{Z}$

ⓑ zero $\mathbb{Z}^-$

ⓒ $\left\{\frac{1}{2}, 5\right\}$ $\mathbb{Z}$

ⓓ $\{3, -5\}$ $\mathbb{Z}^-$

ⓔ $\mathbb{N}$ $\mathbb{Z}$

ⓕ $\mathbb{Z}^+$ $\mathbb{N}$

Solution

ⓐ $\in$

ⓑ $\notin$

ⓒ $\not\subset$

ⓓ $\not\subset$

ⓔ $\subset$

ⓕ $\subset$

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Check Point

Put (✓) or (✗) for each statement of the following:

(a) Zero is the greatest negative number. ()

(b) $\mathbb{Z} = \mathbb{Z}^+ \cup \mathbb{Z}^-$ ()

(c) $\mathbb{Z}^+$ is the set of counting numbers. ()

(d) $\mathbb{Z} = \mathbb{N} \cup \mathbb{Z}^-$ ()

(e) $\mathbb{Z}^+ \cap \mathbb{Z}^- = \varnothing$ ()

Solved Example 4

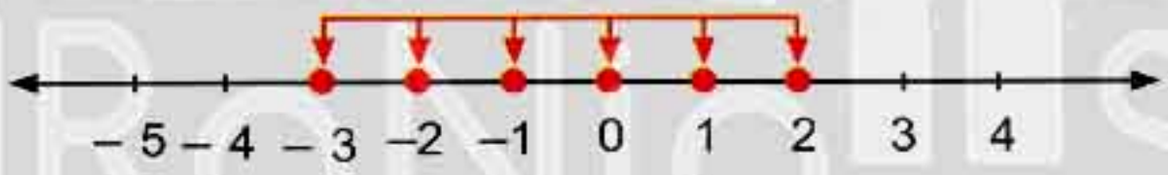
Represent the following sets on the number line:

(a) $\{-3, -2, -1, 0, 1, 2\}$

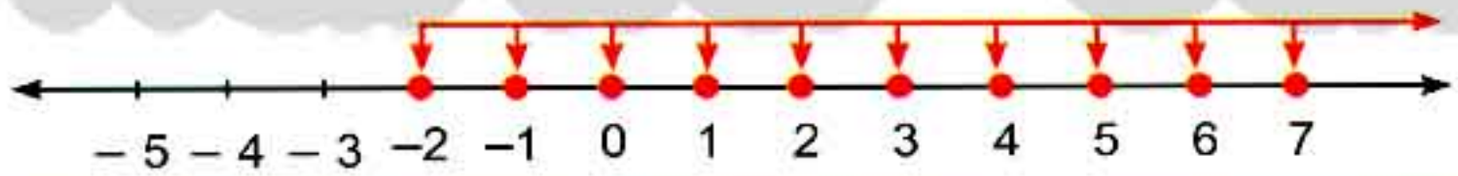
(b) $\{-2, -1, 0, 1, 2, \dots\}$

Solution

(a)



(b)



Check Point

Represent the following sets on the number line:

(a) $\{2, 1, 0, -1, -2, \dots\}$

(b) $\{-1, 0, 1, 2, 3, 4, 5\}$

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The absolute value of an integer:

Definition:

The absolute value of the integer (x) is:

The distance between the location of (x) and the location of (zero) on the number line.

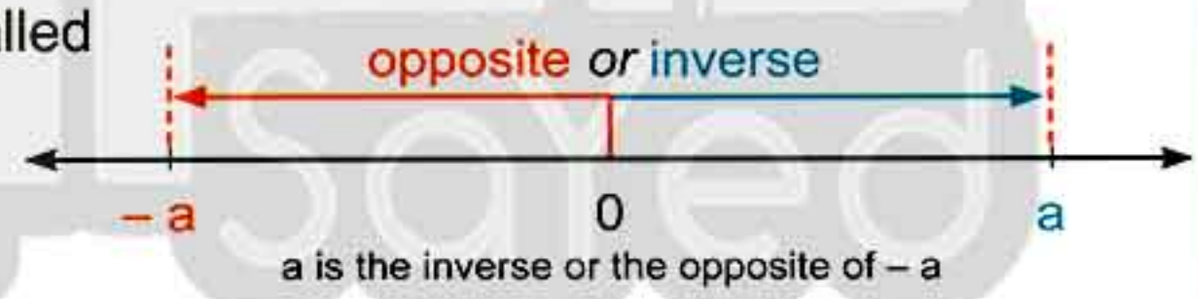
- The absolute value of (x) is denoted by $|x|$.
- The absolute value of any number (except 0) is positive.
- The absolute value of 0 is 0.

For example:

- The absolute value of $(-4) = |-4| = 4$ — (-4) is 4 units away from 0
- The absolute value of $6 = |6| = 6$ — 6 is 6 units away from 0
- The absolute value of $0 = |0| = 0$ — 0 is 0 units away from 0

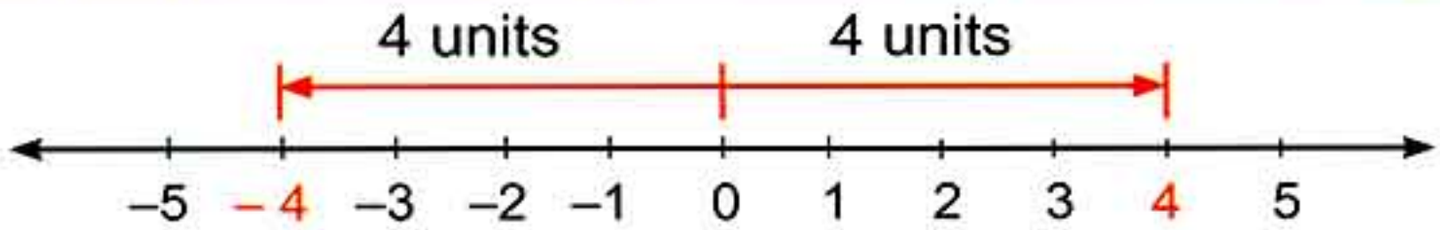
Opposites (or inverses):

Any two numbers that are on two opposite positions and at the same distance from 0 are called (opposites) or (inverses).



For example:

In the following figure:



The two numbers 4, – 4 lie at the same distance from the point zero.

- The inverse (or opposite) of 4 is (– 4).
- The inverse (or opposite) of (– 4) is 4
- Zero is the inverse (or opposite) of itself.

location | موضع

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Solved Example 5

Find each of the following:

ⓐ $|-8|$ ⓑ $|9|$ ⓒ $|0|$

ⓓ $|-1|+|-7|$ ⓔ $|-2| \times |5|$ ⓕ The opposite of 13

Solution

ⓐ $|-8| = 8$ ⓑ $|9| = 9$ ⓒ $|0| = 0$

ⓓ $|-1|+|-7| = 1+7 = 8$ ⓔ $|-2| \times |5| = 2 \times 5 = 10$

ⓕ The opposite of 13 is -13

Solved Example 6

In each of the following find the value of x:

ⓐ If $|-2| = x$, then $x =$ ⓑ If $|5| = x$, then $x =$

ⓒ If $|x| = 5$, then $x =$ or $x =$ ⓓ If $|x| =$ zero, then $x =$

ⓔ If $-|-3| = x$, then $x =$ ⓕ If $x + 1 = |-2|$, then $x =$

Solution

ⓐ $x = 2$ ⓑ $x = 5$ ⓒ $x = 5$ or $x = -5$ ⓓ $x =$ zero

ⓔ $x = -3$ ⓕ If $x + 1 = |-2|$, then $x + 1 = 2$ So, $x = 2 - 1 = 1$

Check Point

Find each of the following:

(a) $|-10| =$

(b) If $|x| = 10$, then $x =$ or $x =$

(c) If $x + |-3| = |-4|$, then $x =$

(d) If $-|-10| = x$, then $x =$

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EXERCISE 1 The set of integers (Z)

1 *Complete the following using one of the following words (positive – negative – zero):*

a) Moving forward is represented by numbers, while moving backward is represented by numbers.

b) Moving from zero point to the right side is represented by numbers, while moving to the left side is represented by numbers.

c) Descending below the sea level is represented by numbers.

d) Moving high above the sea level is represented by numbers.

e) The sea level itself is represented by the number

2 *Write an integer to represent each situation of the following:*

a) A profit of L.E. 2500

b) A bank withdrawal of L.E. 1000

c) Someone is diving at the depth of 20 m.

d) The temperature is 10° C above zero.

e) Moving 30 metres forward.

f) A bank deposit of L.E. 5000

g) Moving 56 metres backward.

h) 160 metres above the sea level.

i) The temperature is 7° C below zero.

j) A loss of L.E. 150

3 *Represent each of the following numbers on the number line:*

a) –1, 0, 3, 4, 5

b) –3, –2, –1, 0, 1, 2, 3

c) 6, –3, zero, –1, 3, 5

d) –2, –3, –4, ...

withdrawal	سحب	bank deposit	إيداع بنكى	diving	الغطس

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4 **Mark (true) or (false) and give the reason:**

a) Zero is a small positive number. () because:

b) $\mathbb{Z} = \mathbb{Z}^+ \cup \mathbb{Z}^-$ () because:

c) $\mathbb{Z}^+$ is the set of counting numbers. () because:

d) $\mathbb{Z} = \mathbb{N} \cup \mathbb{Z}$ () because:

e) $\mathbb{Z}^+ \cup \mathbb{Z}^- = \{0\}$ () because:

5 **Write each of the following sets using the listing method:**

a) Set of integers greater than –2.

b) Set of integers less than –5.

c) Set of integers between – 4 and 3.

d) Set of negative integers where the absolute value of each is greater than 4.

e) Set of negative integers.

f) Set of odd integers.

g) Set of negative even integers.

h) Set of integers between –3 and 13.

6 **Put the suitable sign ($\in$, $\notin$, $\subset$ or $\not\subset$):**

a) -9 $\mathbb{Z}$

b) $-\frac{49}{7}$ $\mathbb{N}$

c) $\mathbb{Z}^-$ $\mathbb{Z}$

d) $-\frac{35}{25}$ $\mathbb{Z}$

e) $\mathbb{Z}^+$ $\mathbb{N}$

f) Zero $\mathbb{N}$

g) $|-8|$ $\mathbb{N}$

h) Zero $\mathbb{Z}^-$

i) $\varnothing$ $\mathbb{Z}$

7 **Choose the correct answer:**

a) $\mathbb{Z}^+ - \mathbb{Z}^- =$ ($\varnothing$ or $\mathbb{N}$ or $\mathbb{N} - \{0\}$ or $\mathbb{Z}$) *(Giza 2017)*

b) $\mathbb{Z}^+ \cup \{0\} =$ ($\varnothing$ or $\mathbb{Z}^-$ or $\mathbb{Z}$ or $\mathbb{N}$) *(Cairo 2019)*

c) $\left|\frac{2}{3}\right| + \left|-\frac{1}{3}\right|$ $\mathbb{Z}$ ($\in$ or $\notin$ or $\subset$ or $\not\subset$)

d) If $x \subset \{2, -3\} \cap \{5, -3\}$, then $x =$ ($\{2\}$ or $\{-3\}$ or $\{-5\}$ or $\{5\}$)

e) $|-5| + 3 =$ $\mathbb{Z}$ ($\in$ or $\notin$ or $\subset$ or $\not\subset$) *(Alex. 2016)*

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f) $|-5| + |7| =$ (– 12 or 12 or – 2 or 2) *(Cairo 2019)*

g) If $|-2| = x$, then $x =$ (– 2 or 2 or zero or 4) *(Cairo 2017)*

h) $\mathbb{Z}^+ \cap \mathbb{Z}^- =$ ($\varnothing$ or $\mathbb{Z}$ or π or $\{0\}$) *(Alex. 2017)*

i) $\frac{13}{5}$ $\mathbb{Z}$ ($\in$ or $\notin$ or $\subset$ or $\not\subset$)

j) $\frac{6-6}{8}$ $\mathbb{Z}$ ($\in$ or $\notin$ or $\subset$ or $\not\subset$)

k) $|-9| + 3$ $\mathbb{Z}$ ($\in$ or $\notin$ or $\subset$ or $\not\subset$) *(Assuite 2019)*

l) -7 $-|-9|$ (> or = or < or ≤) *(Damietta 2013)*

8 Complete each of the following:

a) $|-7| =$ *(Cairo 2011)*

b) $\mathbb{Z}^+ \cup \{5\} =$

c) $\mathbb{Z}^+ \cap \mathbb{Z}^- =$ *(New Valley 2011)*

d) $\mathbb{Z} = \mathbb{Z}^+ \cup$... $\cup$

e) $\mathbb{Z}^+ \cup \mathbb{N} =$ *(Cairo 2019)*

f) $\mathbb{N} \cup \mathbb{Z}^- =$

g) $\mathbb{Z} \cap \mathbb{N} =$

h) $\mathbb{Z} -$ {zero} = ...

i) $|-2| + 2 =$ *(Cairo 2016)*

j) $\mathbb{Z} - \mathbb{Z}^- =$

k) $\mathbb{Z}^+ - \mathbb{Z}^- =$

l) The greatest negative integer is

m) is the smallest positive integer. *(Minia 2019)*

9 Find the result of each of the following:

a) $|-3| + |5| =$

b) $|3| \times |-2| =$

c) $7 \times |-12| =$

d) $|-45| \div |-9| =$

e) $|-12| + |13| =$

f) $|-7| - |7| =$

10 On the number line, colour each number of the following and its inverse with the same colour.

a) 6 b) – 4 c) – 9

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11 *Write the inverse of each of the following numbers:* 113, – 9, zero, 7, 8.

12 *Write the opposite (or inverse) of each integer:*

a) – 4 b) 16 c) –100 d) | – 5 |

e) 0 f) – 99 g) | 6 | h) – | – 3 |

13 *Determine the value of the integer (b) in each of the following cases:*

a) | b | = 7 b) | b | = 16 c) | – 9 | = b

14 *Find the value of (a) in each of the following cases:*

a) | a | = 3 b) a + 2 = | – 8 | c) | – 9 | = a

d) a = | – 9 | –9 e) a = | – 5 | + 5 f) a = 12 ÷ | – 3 |

Cumulative Exercise

15 *Find the value of x to get a true statement:*

a) $-5 \in \{-1, 0, -3, x\}$ b) $-9 \in \{-1, -5, x, -13\}$

c) $x \in \{5, -3\} \cap \{5, 3\}$ d) $x \in \{2, 5, -3\} \cap \{-5, -2, -3\}$

e) $\{x\} \cap \{5, 8\} = \{8\}$ f) $\{2, x\} \cup \{-4, 0, 4\} = \{0, -2, 2, -4, 4\}$

g) $-9 \in \{x, -3\} - \{-3, 7, 9\}$

THINK AND EXPLORE

16 If $|-5| \notin \{x, -5, 3\}$, find the value of x.

Information from UNICEF

I eat vegetables with every meal to give my body the vitamins it needs.

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Lesson 2

ORDERING AND COMPARING INTEGERS

Aims

At the end of this lesson, you will be able to:

recognise the concept of ordering integers on the number line.

watch video

WARM UP

All the students ask, "How can we order the integers?"

The teacher said, "You have studied before that "

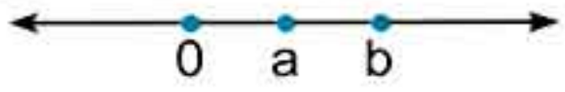
(1) Zero is the smallest number in the non-negative integers which is $= \mathbb{Z}^+ \cup \{0\} = \mathbb{N}$



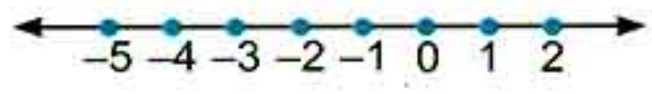
ascending

(2) On the opposite number lines:

- ***Since*** the number (b) lies to the right of (a), then ***b > a***



- ***Since*** the number (a) lies to the left of (b), then ***a < b***
- The previous property is available for all integers on the number line.



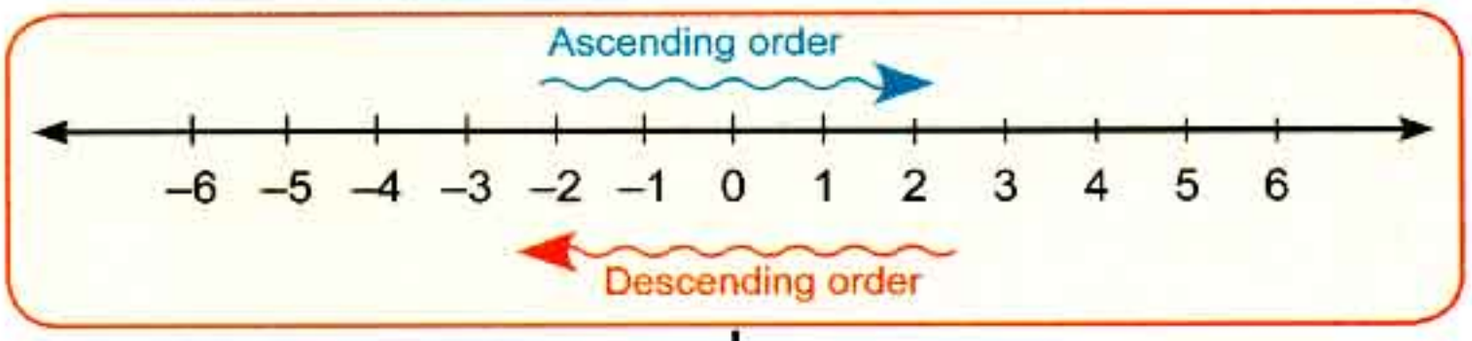
i.e:
- –1 lies to the right of –3 So, –1 > –3
- – 5 lies to the left of –3 So, –5 < –3
- Zero is the greatest number in the non-positive numbers.



descending

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Ordering the integers (Z) on the number line:



Ascending order

(from the smallest to the greatest)
moving from left to right
(..... –3 < –2 < –1 < 0 < 1 < 2 < 3 <)

Descending order

(from the greatest to the smallest)
moving from right to left
(..... 3 > 2 > 1 > 0 > –1 > –2 > –3 >)

Solved Example 1

Write the previous integer and the next integer for each of the following:

(a) –7
(b) 15
(c) –23
(d) Zero

Solution

	The previous integer	← The integer →	The next integer
(a)	– 8	– 7	– 6
(b)	14	15	16
(c)	– 24	– 23	– 22
(d)	–1	zero	1

Check Point

State the previous and next integers for each of the following:

(a) – 23 **(b)** 0 **(c)** – 18

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Unit 1 The integer numbers

REMARKS

1. Any positive integer is greater than any negative integer.
2. Zero is smaller than any positive integer and is greater than any negative integer.
3. The least (or the smallest) positive integer is (1).
4. The greatest negative integer is (–1).
5. We cannot determine the smallest negative integer.

Solved Example 2

Put the suitable sign (< or = or >) in each of the following: *(State the reason.)*

ⓐ 8 –3 ⓑ –7 –12 ⓒ 5 13

ⓓ | –1 2 | 12 ⓔ – | – 8 | –12 ⓕ – | 6 | zero

ⓖ | –11 | | 0 | ⓗ – | – 99 | | 0 |

Solution

ⓐ 8 > – 3 (Because 8 lies at the right of – 3 on the number line.)

ⓑ –7 > –12 (Because –7 lies at the right of –12 on the number line.)

ⓒ 5 < 13 (Because 5 lies at the left of 13 on the number line.)

ⓓ | –12 | = 12 (Because the absolute value of any number except 0 is positive.)

ⓔ – | – 8 | > –12 (Because – | – 8 | = – 8)

ⓕ – | 6 | < 0 (Because – | 6 | = – 6)

ⓖ | –11 | > | 0 | (Because | –11 | = 11 and | 0 | = 0)

ⓗ – | – 99 | < | 0 | (Because – | – 99 | = – 99 and | 0 | = 0)

Check Point

Complete by using the correct sign (< or = or >):

(a) 3 – 3 **(b)** – | –13 | 10 **(c)** –10 –11

(d) | 0 | | –17 | **(e)** – | –12 | | 0 | **(f)** – | – 5 | – | – 9|

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Solved Example 3

Represent each of the following sets on the number line:

(a) $X = \{4 , 3 , 2 , 0 , -1 , -2\}$

(b) Y is the set of integers between –3 and 3

(c) L is the set of integers greater than –2

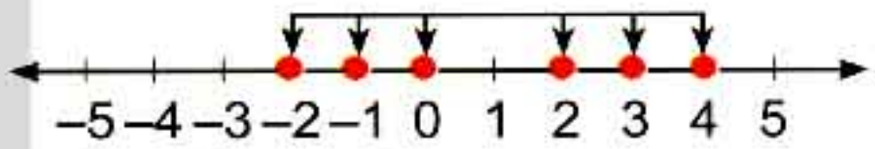
(d) M is the set of non-positive even integers.

(e) $A = \{x : x \in \mathbb{Z}, -4 \leq x < 1\}$.

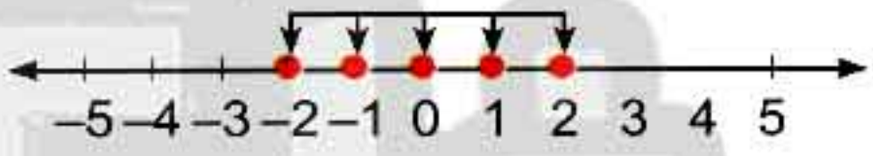
(f) $B = \{x : x \in \mathbb{Z}, x < 3\}$.

Solution

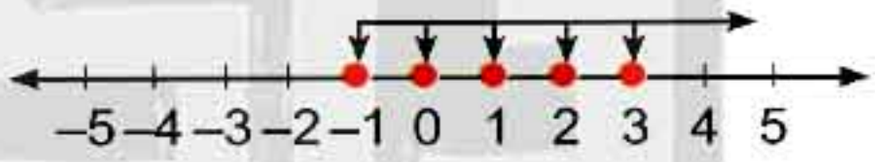
(a) $X = \{4 , 3 , 2 , 0 , -1 , -2\}$



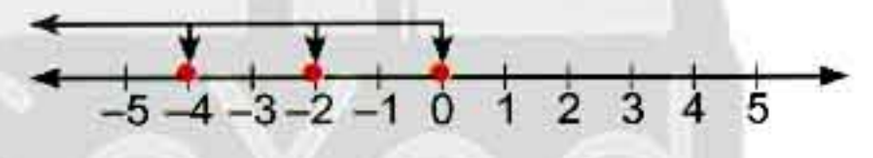
(b) $Y = \{-2 , -1 , 0 , 1 , 2\}$



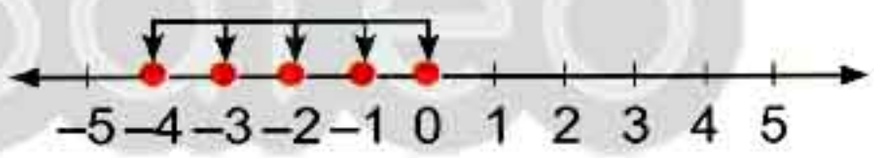
(c) $L = \{-1 , 0 , 1 , 2 , 3 , \ldots\ldots\}$



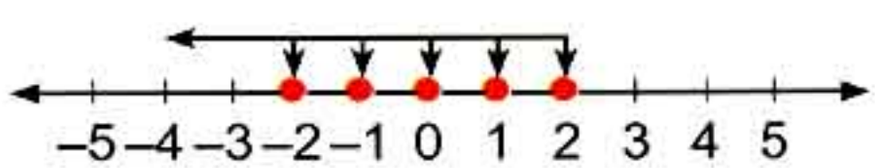
(d) $M = \{0 , -2 , -4 , -6 , \ldots\ldots\}$



(e) $A = \{-4 , -3 , -2 , -1 , 0\}$



(f) $B = \{2 , 1 , 0 , -1 , -2 , \ldots\ldots\}$



Check Point

Represent each of the following sets on the number line:

(a) $C = \{c : c \in \mathbb{N}, c \leq 1\}$

(b) The set of non-positive odd integers.

(c) $X = \{x : x \in \mathbb{N}, -1 \leq x < 3\}$

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Solved Example 4

Which of the following integers are arranged from the smallest to the greatest?

(a) 0 ,14 , –15, 16 , –17 , –19

(b) 16 ,14 , 0 , –15 , –17 , –19

(c) –19 ,–17 , –15, 0 , 14 , 16

(d) None of the previous

Solution

(c) –19 , –17 , –15 , 0 , 14 , 16

Check Point

Which of the following integers are arranged from the greatest to the smallest?

(a) 28 , 19 , 0 , – 21 , – 36 , – 39

(b) – 49 , – 38 , 0 , 22 , 27 , 30

(c) – 52 , – 47 , – 40 , 0 , 16 , 20

(d) None of the previous

Solved Example 5

(a) ***Arrange in ascending order:*** – 4 , 0 , 25 , | –12 | , –11 , 27

(b) ***Arrange in descending order:*** –17 , –19 , –2 , | –13 | , 24 , zero

Solution

(a) Since | –12 | = 12, then the ascending order is:

–11 , – 4 , 0 , | –12 | , 25 , 27

(b) Since | –13 | = 13, then the descending order is:

24 , | –13 | , 0 , –2 , –17 , –19

Check Point

Arrange each of the following numbers:

(a) 6 , –2 , 8 , –1 and 0 in ascending order.

(b) –11 , –3 , – | –5 | , –21 , 13 and | –1 | in descending order.

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EXERCISE 2

Ordering and comparing integers

1 ***Put the suitable sign (< , = or >) in each :***

a) 3 –6

b) –7 17

c) | –13 | 3

d) | –5 | 5

e) 3 + | –3 | 8

f) – | –4 | 2

g) zero | zero |

h) | –5 | – | –4 | 0

2 ***Choose the correct answer:***

a) The integer number which is included between –2 and 3 is
(– 4 *or* – 3 *or* – 2 *or* –1)

b) | –2 | 1
(> *or* < *or* = *or* ≤)

c) 0 >
(– 6 *or* 0 *or* 1 *or* 2)

d) – 3 <
(– 5 *or* – 4 *or* – 3 *or* – 2)

e) – 6 – | – 8 |
(< *or* > *or* = *or* ≤)

f) The integer number just before – 5 is
(– 6 *or* – 4 *or* 4 *or* 6)

g) The number of integers which lie between –3 and 3 is
(3 *or* 4 *or* 5 *or* 6)

h) The integer number next to 23 is *(Sharkia 2015)*
(15 *or* 22 *or* 23 *or* 24)

i) The number of integers between –2 and 2 is
(2 *or* 3 *or* 4 *or* 5)

j) The greatest non-positive integer is *(Dakahlia 2015)*
(1 *or* – 1 *or* 0 *or* million)

3 ***Write the integers between each two integers of the following:***

a) –4 , 2

b) –1 , 5

c) –7 , zero

d) –2 , –5

e) | –1 | , –3

f) | –2 | , | –9 |

4 ***Write the previous and the next integer for each of the following:***

a) –9

b) 13

c) 23

d) zero

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5 ***Write each of the following sets using the listing method, then represent it on the number line:***

a) The set of integers less than 2

b) The set of integers greater than –2

c) $B = \{ x : x \in \mathbb{Z}, -5 \leq x < 1 \}$

d) $C = \{ x : x \in \mathbb{Z}, -3 \leq x \leq 3 \}$

6 ***Write each of the following sets using the listing method:***

a) $X = \{ x : x \in \mathbb{Z}, x < -3 \}$

b) $X = \{ x : x \in \mathbb{Z}, x \leq -2 \}$

c) $X = \{ x : x \in \mathbb{Z}, -1 \leq x < 5 \}$

d) $X = \{ x : x \in \mathbb{Z}, -5 < x < \text{zero} \}$

e) The set of integers greater than – 5 and smaller than 4.

f) The set of integers between – 2 and 5.

g) The set of non-positive odd integers.

h) The set of integers greater than – 3.

7 ***Represent each of the following numbers on the number line, then arrange them:***

a) – 3 , | – 7 | , 0 , 5 and – 5 (ascendingly)

b) | – 4 | , 9 , – 2 , –3 and 1 (descendingly)

8 ***Which of the following integers is listed in ascending order.....?***

a) – 30 , – 25 , – 20

b) 0, 3 , 5 , 7

c) 26 , 24 , 22

d) – 7 , – 5 , | – 9 | , 0 , 14

9 ***Which of the following integers is listed in descending order.....?***

a) 0 , –7 , – 14 , – 21

b) 19 , 17 , 15

c) – 2 , – 6 , – 10

d) – 11 , – 13 , – 15

10 ***Arrange the following numbers in ascending order:***

a) 6 , – 60 , 2 , –17 , – 22 and 0

b) 1 , – 9 , – 45 , 7 , 19 and 30

c) 27 , – 60 , 50 , –38 , | – 20 | and zero

d) –17 , –11 , 0 , 5 , | – 3 | and | 4 |

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11 ***Arrange the following numbers in descending order:***

a) 1 , –11 , 3 , –1 , –8 and 5

b) 60, –60 , –70, –50, | 70 | and –8

c) –8 , –9 , 7 , 15 , | –12 | and | –3 |

d) | –7 | , 8 , | –9 | , zero , –8 and 17

12 ***Each of the following integers increases by a constant value, determine this constant value and complete the pattern:***

a) – 10 , – 9 , – 8 , ... , ... , ...

b) – 50 , – 40, – 30 , ... , ... , ...

c) – 2 , 0, 2 , 4 , ... , ... , ...

d) – 7, – 6, – 5, ... , ... , ...

13 ***Complete in the same pattern:***

a) – 15 , – 14 , – 13 , ... , ...

b) – 12 , – 15 , – 18, ... , ...

c) – 10 , – 12 , – 14 , ... , ...

d) – 30 , – 20 , – 10 , ... , ...

e) – 25 , – 20 , – 15 , ... , ...

f) – 6 , – 3 , 0 , 3 , ... , ...

Cumulative Exercise

14 ***Complete by using (> , = or <):***

a) 15 + | – 15 | the opposite of 15

b) | – 17 | – 7 the opposite of – | – 12 | + 5

c) The value of x where x + 2 = | – 5 | – 13

THINK AND EXPLORE

15 If the temperature recorded in one city is $3^{\circ}C$

and in another city is $(-7)^{\circ}C$

Calculate the difference between the temperatures of the two cities.

Information from UNICEF

I help my family prepare food at home. I prefer home-made food to fast food.

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Lesson 3

ADDING AND SUBTRACTING INTEGERS

Aims

At the end of this lesson, you will be able to:

(1) identify the possibility of addition and subtraction operations in $\mathbb{Z}$

(2) acknowledge the properties of addition and subtraction operations in $\mathbb{Z}$

WARM UP

watch video



- Ahmed keeps himself healthy. He knows that when he eats, he adds calories and when he exercises, he subtracts calories.
- Ahmed uses integers to calculate daily calories.
- In the first week Ahmed's weight decreased by 3 kg. i.e. we add (–3).
- In the second week his weight increased by 1 kg. i.e. we add (+1).
- The total weight will decrease by 2 kg. because (–3) + (1) = –2

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First Adding integers:

Adding integers by using the number line:

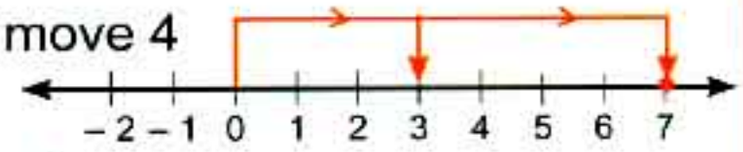
a) Adding two positive integers:

Solved Example 1

Find: 3 + 4 on the number line.

Solution

Start at zero, then move 3 units to the right to reach 3, then move 4 units to the right you will reach 7, so 3 + 4 = 7



i.e: adding positive integers is the same as adding natural numbers.

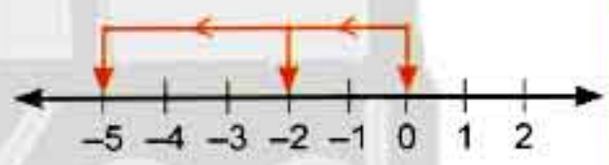
b) Adding two negative integers:

Solved Example 2

Find: (–2) + (–3) on the number line.

Solution

Start at zero, then move 2 units to the left to reach (–2), then move 3 units to the left you will reach – 5, so (–2) + (– 3) = – 5



i.e: adding two negative integers = a negative integer

Notice that

- The sum of two positive integers is a positive integer.
 EX: 3 + 4 = 7
- The sum of two negative integers is a negative integer.
 EX: (– 7) + (– 3) = (–10)

Check Point

Use the number line to find:

(a) 5 + 3 **(b)** (– 5) + (– 4) = ...

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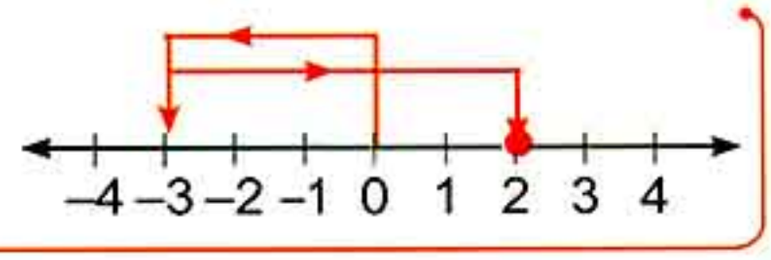
c) Adding two integers one of them is positive and the other is negative:

Solved Example 3

Find: (– 3) + 5 on the number line.

Solution

Start at zero, then move 3 units to the left to reach (–3), then move 5 units to the right, you will reach 2 so, (–3) + 5 = 2.

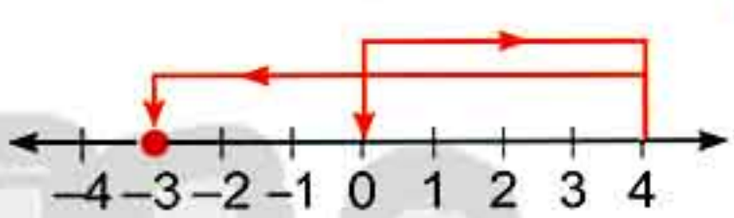


Solved Example 4

Find: 4 + (–7) on the number line.

Solution

Start at zero, then move 4 units to right to reach 4, then move 7 units to left, you will reach (–3) so, 4 + (–7) = –3

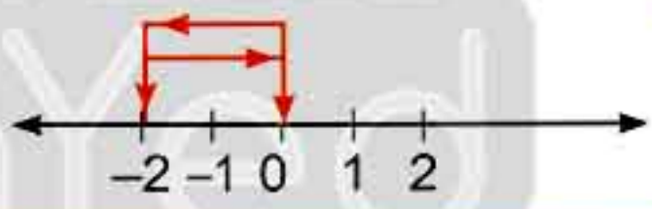


Solved Example 5

Find: –2 + 2 on the number line.

Solution

Start at zero, then move 2 units to left to reach (–2), then move 2 units to right, to reach Zero so, – 2 + 2 = Zero



Notice that

The sum of two integer numbers whose signs are different is a positive integer or a negative integer or zero.

Check Point

Use the number line to find:

(a) (–6) + 3 = ... **(b)** 7+ (–8) = ...

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Adding integers without using the number line:

To add integers we have two cases

(1) If they have the same signs:

Keep the same sign and add their absolute values.

For example: $(-5)+(-3)=-\big(|-5|+|-3|\big)=-8$

(2) If their signs are different:

Keep the sign of the number with the greater absolute value and subtract the smaller absolute value from the greater absolute value.

For example:

ⓐ $(-5)+3$



$=-\big(|-5|-|3|\big)=-2$

ⓑ $5+(-3)$



$=|5|-|-3|=2$

Solved Example 6

Find the sum of each of the following:

ⓐ $(-3)+(-8)$ ⓑ $(-6)+5$

Solution

ⓐ $(-3)+(-8)=-\big(|-3|+|-8|\big)=-11$ ⓑ $(-6)+5=-\big(|-6|-|5|\big)=-1$

Check Point

Calculate the value of each of the following:

(a) $(-8)+(-6)=$ **(b)** $(-4)+5=$ **(c)** $10+(-20)=$

REMARK

We can use a calculator to check our answers.

For example: to add (–15) + (–25) we press the keys of the calculator as follows:

(– 15) + (– 25) = -40



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Properties of addition operation in ℤ:

a Closure property:

- If $a \in \mathbb{Z}, b \in \mathbb{Z}$, then $a + b \in \mathbb{Z}$

i.e. The sum of any two elements of ℤ is always an element of ℤ.

EX. $2 \in \mathbb{Z}, 3 \in \mathbb{Z}$, then $2 + 3 = 5 \in \mathbb{Z}$

- ℤ is closed under addition operation.

i.e. Addition operation is always possible in ℤ.

b Commutative property:

- If $a \in \mathbb{Z}, b \in \mathbb{Z}$, then $a + b = b + a$

i.e. Interchanging the two numbers doesn't affect the sum.

EX. $2 \in \mathbb{Z}, 3 \in \mathbb{Z}$, then $2 + 3 = 3 + 2$

- Addition operation is commutative in ℤ.

c Associative property:

- If $a \in \mathbb{Z}, b \in \mathbb{Z}, c \in \mathbb{Z}$, then: $(a + b) + c = a + (b + c) = a + b + c$

EX. $(2 + 3) + 5 = 5 + 5 = 10$ and $2 + (3 + 5) = 2 + 8 = 10$

, then $(2 + 3) + 5 = 2 + (3 + 5) = 10$

i.e. We can neglect the brackets and add any two numbers together.

- Addition operation is associative in ℤ.

d Existence of the additive identity: (or the identity of addition)

- If $a \in \mathbb{Z}$, then $a + 0 = 0 + a = a$

EX. $(-3) + 0 = 0 + (-3) = (-3)$

- Zero is the additive identity in ℤ.

i.e. Zero is the neutral additive element in ℤ.

e Existence of the additive inverse: (opposite property)

- If $a \in \mathbb{Z}$, then $a + (-a) = (-a) + a = 0$ ***i.e.*** a is the additive inverse of $(-a)$

EX.(–7) is the additive inverse of 7, 0 is the additive inverse of 0

- For each integer, there is an additive inverse.

Properties

closure property | خاصية الانغلاق

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Solved Example 7

Use the properties of addition to find:

(a) 8 + 20 + (–8) (b) 22 + (–13) + (–22) + 3

Solution

(a) 8 + 20 + (–8)
= 8 + (–8) + 20 (Commutative property)
= [8 + (–8)] + 20 (Associative property)
= 0 + 20 (Additive inverse property)
= 20 (Additive identity)

(b) 22 + (–13) + (–22) + 3
= 22 + (–22) + (–13) + 3 (Commutative property)
= [22 + (–22)] + [(–13) + 3] (Associative property)
= 0 + (–10) (Additive inverse property)
= –10 (Additive identity)

Check Point

Using the properties of addition, find the following:

(a) 5 – 8 + (–5) **(b)** 25 + 14 + 75

Solved Example 8

Check the closure property of addition on the set X, where: X = {– 3 , 0 , 3}

Solution

Atip: We calculate the sum of each two elements in X and tabulate that as shown in the opposite table:

If → all the results ∈ X, then: X is closed under addition.
→ anyone of the results ∉ X, then: X is not closed under addition.

+	–3	0	3
–3	–6	–3	0
0	–3	0	3
3	0	3	6

From the table: X is not closed under addition because 3 + 3 = 6 ∉ X or (– 3) + (– 3) = – 6 ∉ X

Check Point

Check the closure property of addition on the set X: where X = {–2 , 0}

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Second Subtracting integers:

Since $7 - 5 = 2$

And $7 + (-5) = 2$

the same results

So, subtrscting an integer from another one means that:

We add its additive inverse (or its opposite).

Definition: Subtracting two integers **a** , **b** is defined as:
$a - b = a +$ the additive inverse of b, then
$a - b = a + (-b)$

For example:

- $5 - 9 = 5 + (-9) = -4$
- $6 - (-3) = 6 + 3 = 9$

Note that

$\because 0 - (-3) = 3$

$\therefore -(-3) = 3$

Important note:

Now we can say that the subtraction of two integers is always possible in $\mathbb{Z}$.

Solved Example 9

Find the result of each of the following:

(a) $(-4) - 3$ (b) $7 - 9$ (c) $0 - (-7)$

(d) $(-5) - (-4)$ (e) $6 - (-2)$ (f) $(-2) -$ zero

Solution

(a) $(-4) - 3 = (-4) + (-3) = -7$

(b) $7 - 9 = 7 + (-9) = -2$

(c) $0 - (-7) = 0 + 7 = 7$

(d) $(-5) - (-4) = (-5) + (4) = -1$

(e) $6 - (-2) = 6 + (2) = 8$

(f) $(-2) -$ zero $= (-2) +$ (zero) $= -2$

Check Point

Calculate each of the following:

(a) $(-4) - (-3)$ **(b)** $0 - (-7)$ **(c)** $4 + (-6)$

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Properties of subtraction operation in ℤ:

Properties

a → Closure property:

- If $a \in \mathbb{Z}$, $b \in \mathbb{Z}$, then $a - b \in \mathbb{Z}$

i.e. If we subtract any two integers the result is always an integer.

So, ℤ is closed under subtraction operation.

EX. $3 \in \mathbb{Z}$, $(-2) \in \mathbb{Z}$ then $3 - (-2) = 3 + 2 = 5 \in \mathbb{Z}$.

- We can say that: The subtraction operation is always possible in ℤ.

b → Not commutative in ℤ:

If $a \in \mathbb{Z}$, $b \in \mathbb{Z}$, then $a - b \neq b - a$.

i.e. **Subtraction operation is not commutative in ℤ.**

EX. $7 \in \mathbb{Z}$, $5 \in \mathbb{Z}$ then $7 - 5 = 2$ but $5 - 7 = 5 + (-7) = -2$

So, $7 - 5 \neq 5 - 7$, etc.

c → Not associative in ℤ:

If $a \in \mathbb{Z}$, $b \in \mathbb{Z}$ and $c \in \mathbb{Z}$, then $(a - b) - c \neq a - (b - c)$

i.e. **Subtraction operation is not associative in ℤ.**

EX. $6 \in \mathbb{Z}$, $4 \in \mathbb{Z}$ and $2 \in \mathbb{Z}$, then:

$(6 - 4) - 2 = 2 - 2 = 0$ but $6 - (4 - 2) = 6 - 2 = 4$.

So, $(6 - 4) - 2 \neq 6 - (4 - 2)$.

d → There is no neutral element:

If $a \in \mathbb{Z}$, then $a - 0 \neq 0 - a \neq a$

i.e. **Zero is not a neutral element in subtraction.**

EX. $3 - 0 \neq 0 - 3$ because $3 - 0 = 3$ but $0 - 3 = -3$

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Solved Example 10

Find the result of each of the following:

(a) $7 - (4 - 1)$ (b) $(7 - 4) - 1$

(c) What do you notice from (a) and (b)?

Solution

(a) $7 - (4 - 1) = 7 - 3 = 4$ (b) $(7 - 4) - 1 = 3 - 1 = 2$

(c) We notice that $7 - (4 - 1) \neq (7 - 4) - 1$

i.e. Subtraction is not associative in $\mathbb{Z}$.

Check Point

Find the result of each of the following:

$9 - (7 - 4)$ and $(9 - 7) - 4$, what do you notice?

Solved Example 11

If $a = 5$, $b = -3$ and $c = -7$, find:

(a) $a - (b - c)$ (b) $(a - b) - c$ (c) $(b + c) - a$

Solution

(a) $a - (b - c) = 5 - [(-3) - (-7)] = 5 - [(-3) + 7] = 5 - 4 = 1$

(b) $(a - b) - c = [5 - (-3)] - (-7)$

$= [5 + 3] + 7 = 8 + 7 = 15$

(c) $(b + c) - a = [(-3) + (-7)] - 5 = (-10) - 5 = (-10) + (-5) = -15$

Check Point

If $a = -1$, $b = 4$ and $c = -4$, find:

(a) $c + b$ **(b)** $a - (c - b)$ **(c)** $a - c - b$ **(d)** $b + a - c$

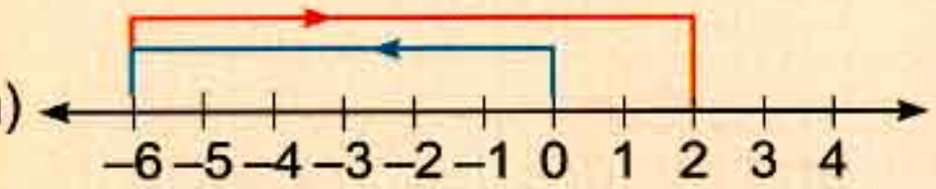
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EXERCISE 3

Adding and subtracting integers

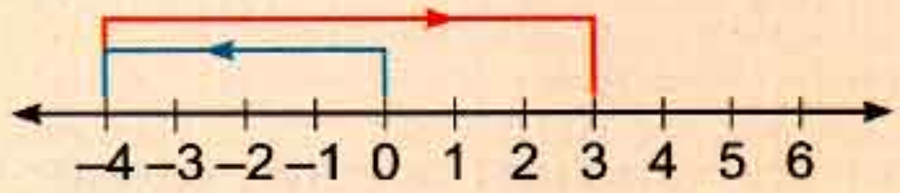
1 ***By using the number line, complete the following:***

a)



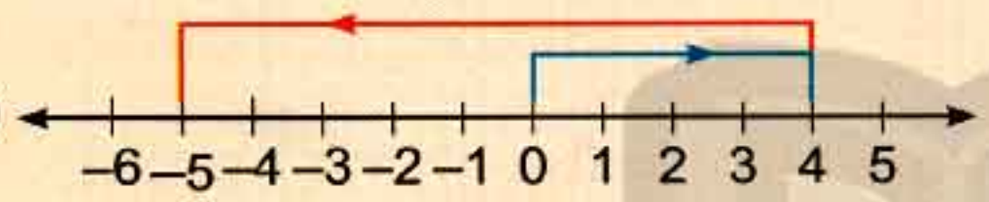
(– 6) + 8 = ...

b)



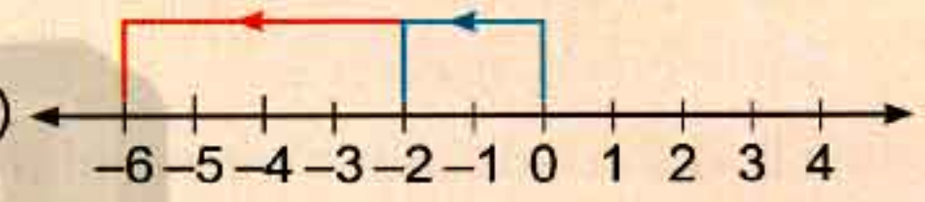
(– 4) + 7 = ...

c)



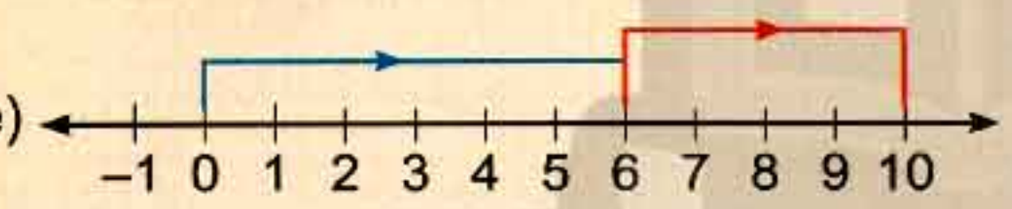
4 + (– 9) = ...

d)



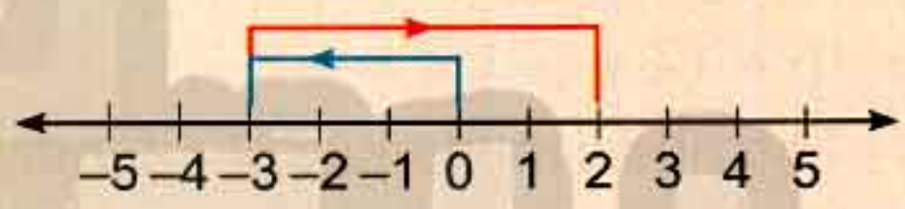
(– 2) + (– 4) = ...

e)



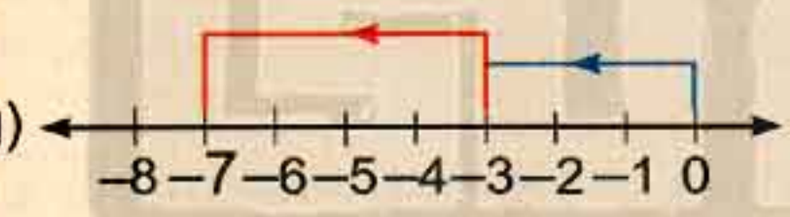
6 – (– 4) = ...

f)



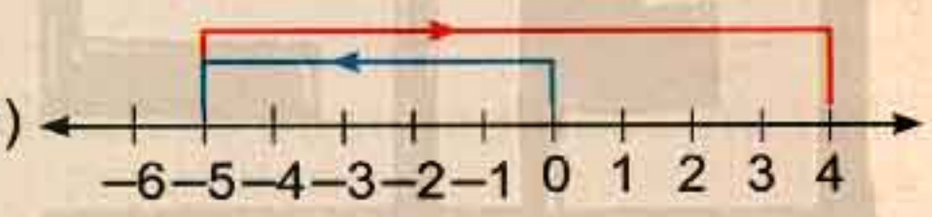
– 3 – (– 5) = ...

g)



..... + ... = ...

h)



..... + ... = ...

2 ***Use the number line to find the sum of each of the following:***

a) 3 + 4 b) (– 7) + 5 c) 5 + (–1)

d) 2 + (– 7) e) 3 – 5 f) 3 – (– 7)

3 ***Find the result of each of the following:***

a) 9 + (– 5) b) (– 8) + (– 2)

c) (– 16) + 14 d) Zero + (– 3)

e) (– 15) + (– 10) f) 20 + (– 30)

g) | – 15 | + | – 9 | h) – | – 22 | + 15 + 27

i) – 24 + | – 17 | + (– 9) j) (– 11) + (– 12) + (– 35)

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4 ***Complete each of the following:***

a) $3 + (-2) = (-2) +$ (..... property)

b) $[5 + (-3)] + 2 = 5 +$ (..... $+ 2$) (..... property)

c) $5 +$ $= 5$ (..... property)

d) $(-2) + 8 =$

e) The smallest positive integer is and the greatest negative integer is

f) If $a + (-5) = b + a$, then $b =$

g) If $a + b = b$, then $a =$

h) If b is the additive inverse of a, then $a +$ $= 0$

i) $6 + (-11) =$

j) $(3 + (-5)) + 7 =$ $+ ((-5) + 7)$

k) $15 + 17 + (-15) =$

l) The additive identity of integer numbers is

m) The additive inverse of zero is

n) The additive inverse of (-3) is

5 ***Find the result of each of the following:***

a) $3 - 8$ b) $(-9) - 4$ c) $(-2) - (-5)$

d) $-7 - 0$ e) $0 - (-10)$ f) $0 - 6$

g) $(-25) - (-11)$ h) $|-7| - (-9)$ i) $19 - |-9|$ *(Garbia 2016)*

6 ***Choose the correct answer:***

a) $\left|\frac{6-8}{2}\right| =$ (2 **or** -2 **or** 1 **or** -1)

b) $3 - |-3| =$ (0 **or** 1 **or** 3 **or** 6) *(Giza 2019)*

c) If $a = -2$, $b = -5$, then $a - b =$ (-3 **or** 3 **or** 5 **or** -5)

d) If $x = -5$, then $x - (-11) =$ (-5 **or** 5 **or** 6 **or** -6)

e) The result of subtracting (-9) from (-7) is (2 **or** -2 **or** 1 **or** -1)

f) The result of subtracting (-8) from (-4) is (2 **or** 4 **or** -4 **or** 6)

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g) The result of subtracting (– 9) from 3 is (2 or 21 or 12 or – 12)

h) The result of subtracting (– 8) from (– 12) is (4 or 8 or – 4 or 14)

7 Choose the correct answer:

a) $-|2-3|=$ (– 1 or 1 or – 5 or 5) *(Ismailia 2017)*

b) $4+(-6)>$ (2 or 0 or – 2 or – 4)

c) The additive inverse of (– 5) is (– 10 or – 5 or 5 or 0)

d) $|-5|+$ = zero (– 5 or 5 or 1 or 0)

e) $51+|-4|=$ (52 or 53 or 54 or 55)

f) $\left|\frac{5-11}{3}\right|=$ $\mathbb{Z}$ ($\in$ or $\notin$ or $\subset$ or $\not\subset$) *(Giza 2019)*

g) $15+8-15=$ (– 15 or 8 or 15 or 23)

h) $-1+5=$ (4 or – 4 or 8 or – 8)

i) Zero + (– 3) = ... ($\frac{1}{3}$ or – 3 or 1 or Zero)

8 Write the missing number:

a) 15 + ... = 0

b) Zero + ... = – 3

c) 7 – = 10

d) + 9 = – 2

9 Complete using the suitable sign $\in$, $\notin$, $\subset$ and $\not\subset$:

a) 📖 $|-9|+3$ $\mathbb{Z}$

b) 📖 $\{9\}$ $\mathbb{Z}$

c) 📖 $\frac{3}{5}$ $\mathbb{Z}$

d) 📖 $\frac{9}{7+7}$ $\mathbb{Z}$

e) 📖 $\frac{6-6}{8}$ $\mathbb{Z}$

f) 📖 $\{-3, \frac{7}{11}\}$ $\mathbb{Z}$

g) $\frac{7+3}{5+25}$ $\mathbb{Z}$

h) $\frac{20}{(-5)+10}$ $\mathbb{Z}$

i) $\frac{-8+|8|}{3}$ $\mathbb{Z}$

10 Put (✓) or (✗):

a) $\mathbb{Z}$ is closed under addition operation. ()

b) The operation of addition is commutative in $\mathbb{Z}$. ()

c) The operation of addition is not associative in $\mathbb{Z}$. ()

d) The additive identity in $\mathbb{Z}$ is one. ()

e) For every $a \in \mathbb{Z}$, then $(-a) \in \mathbb{Z}$, where $a + (-a) =$ zero. ()

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11 ***Use the properties of addition operation in ℤ to get the result of each of the following: (State the property.)***

a) $(-77) + (19) + 17$ *(Kafr El-Sheikh 2017)*
b) 📖 $115 + 198 + (-115)$
c) $23 + (-17) + (-23)$
d) $(-15) + 29 + 15$ *(Sohag 2017)*
e) $225 + 17 + (-25) + 83$
f) $55 + (-225) + 45 + 225$
g) $27 + 157 + (-27) + (-57)$
h) $26 + 20 + (-26) + 80$ *(Minia 2019)*
i) 📖 $-120 + 17 + |3|$
j) 📖 $2015 + 180 + (-1015)$

12 ***Check the closure property of the addition and subtraction operations in each of the following sets:***

a) $\{2, 7, -2\}$
b) $\{-5, 3, 5\}$
c) $\{-2, 0, 2\}$
d) $\{-1, 3, 5, -7\}$
e) $\{2, -1, -2, 9\}$
f) $\{-3, -2, 1, 0, 5, 6\}$
g) 📖 $X = \{-1, 0, 1\}$
h) $L = \{-2, 0, 2\}$
i) 📖 $L = \{-2, -1, 0, 1, 2\}$
j) $M = \{-3, -2, 0, 1, 2\}$

13 ***First: If A = 2, B = –5 and C = –1, find the result of each of the following:***

a) $A + B$
b) $B + C$
c) $A + C$
d) $A + B + C$

Second: If M = –2, N = –5 and L = 3, find the result of each of the following:

a) $M + N + (-L)$
b) $M - N - L$

Cumulative Exercises

14 ***Find the value of x in each of the following:***

a) $|-5| + 0 = x$
b) $(-4) + x = -4$
c) $(-3) + (-9) = x$
d) $x + 5 = 0$
e) $3 + x = 8$
f) $(-2) + x = -10$

15 📖 Ramy had deposited L.E. 6220 in the bank then he withdrew an amount of L.E. 1211, afterwards Ramy deposited another amount of L.E. 2110.
How much is Ramy's credit in the bank?



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16 A submarine at a depth of 90 metres below the sea level went up 60 metres. Use the appropriate calculation to calculate the new depth of the submarine.



17 The temperature recorded in St. Catherine is – 3° C at three o'clock after midnight, while it was 11° C in the afternoon. Calculate the increase in the temperature.



18 The minimum temperature recorded in Paris, is (– 5)° C, while the maximum temperature is 12° C, find the amount of increase.

THINK AND EXPLORE

19 1st: Consider the counting triangles at the following figures, then find the sum of each of the following:

a)  = ...

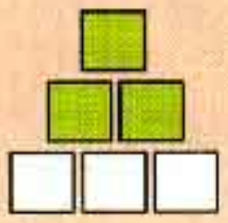
b)  = ...

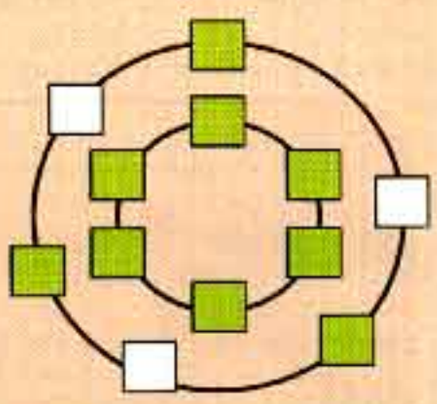
2 = ▲ Red triangle

– 2 = △ White triangle

Zero = ▲△ Both of the two triangles

2nd: Consider the counting squares at the following figures, then find the sum of each of the following:

a)  = ...

b)  = ...

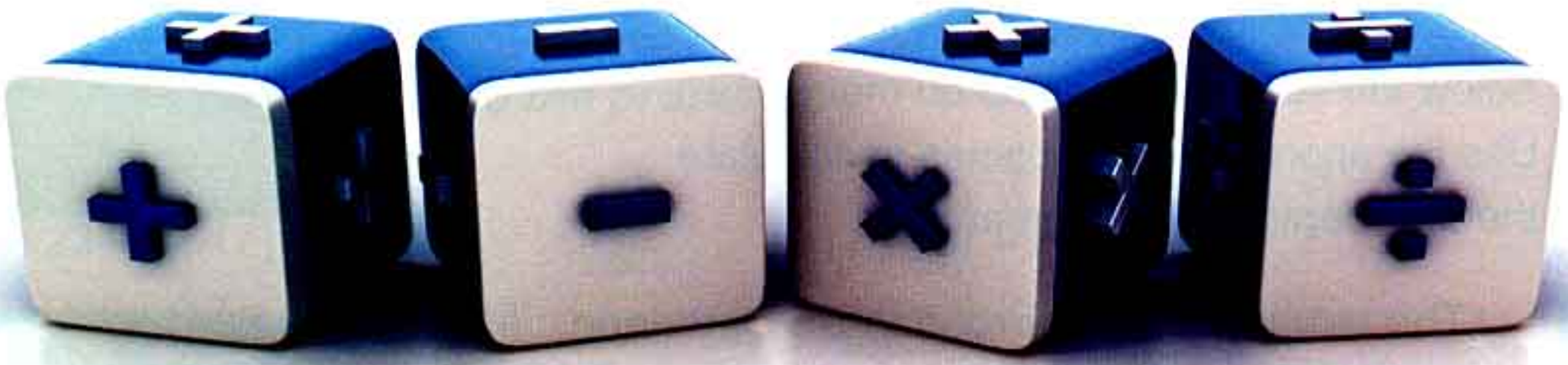
2 = ■ Green square

– 2 = □ White square

Zero = ■ □ Both of the two squares

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$(-2)+(-2)+(-2)$



$(-2)\times 3$

4 Lesson MULTIPLYING AND DIVIDING INTEGERS

Aims

At the end of this lesson, you will be able to:

(1) identify the possibility of multiplication and division operations in $\mathbb{Z}$

(2) recognise the properties of multiplication and division operations in $\mathbb{Z}$

WARM UP

watch video

- The weight of Ahmed is 50 kg, if his weight increases 3 kg per month, then after 4 months his weight will be $= 50 + 3 \times 4$

 $= 50 + 12 = 62$ kg



- Ahmed decided to do some exercises to reduce his weight, if he loses 3 kg from his weight per month, then his weight after 2 months will be $= 62 + (-3) \times 2$

 $= 62 + (-6) = 56$ kg



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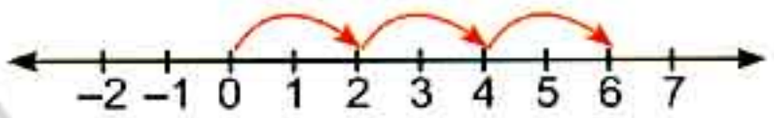
First Multiplying integers:

The possibility of multiplication in ℤ:

Notice each of the following:

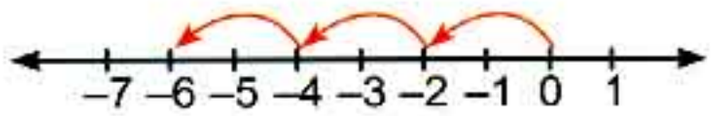
1. The multiplication operation is a repeated addition operation:

Ex. 2 x 3 = 2 + 2 + 2 = 6



By the same way:

(– 2) x 3 = (– 2) + (– 2) + (– 2) = (– 6)



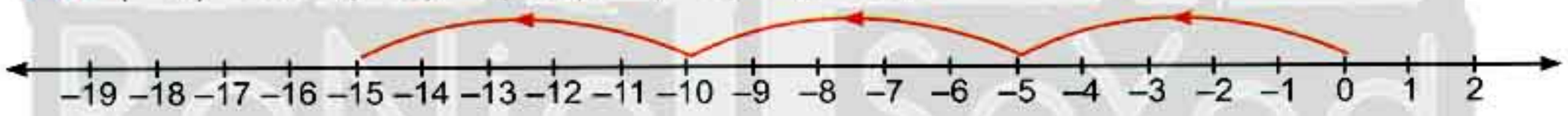
Since the addition of two integers is always possible, then the multiplication of two integers is also always possible.

2. • If we multiply two positive integers, then the result is positive

Ex. 3 x 5 = 15 , 4 x 8 = 32 , so on.

• If we multiply two integers one is positive and the other is negative or vice versa, the result is negative.

Ex. (– 5) x 3 = (– 5) + (– 5) + (– 5) = (– 15)



Also: 5 x (– 3) = (– 3) + (– 3) + (– 3) + (– 3) + (– 3) = (– 15)



3. If we multiply two negative integers, then the result is positive.

$\because -(a) = (-a)$

And $\because -(-a) = a$

$\therefore (-3) \times (-5) = -\big(3 \times (-5)\big) = -\big((-5) + (-5) + (-5)\big) = -(-15) = 15$

Ex. (– 2) x (– 7) = 14

4. If we multiply any integer by zero, then the result is zero.

Ex. (– 5) x 0 = 0 , (– 3) x 0 = 0 , 0 x (– 2) = 0 , so on.

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Summary of the rules of signs for finding the product of two integers:

From the previous, we can conclude that:

(1) If the signs are the same, then the sign of the product is positive:

as $2 \times 6 = 12$ i.e (+ x + = +)

and $-2 \times (-6) = 12$ i.e. (− x − = +)

(2) If the signs are different, then the product is negative.

as $-2 \times 6 = -12$ i.e. (− x + = −)

and $2 \times (-6) = -12$ i.e. (+ x − = −)

(3) Multiplying any integer by zero = zero

as $3 \times 0 = 0$

and $0 \times (-2) = 0$

Solved Example 1

ⓐ $(-7) \times 3 =$ ⓑ $(-7) \times (-10) =$ ⓒ $3 \times (-8) =$

ⓓ $9 \times (-3) =$ ⓔ $(-5) \times (-4) =$ ⓕ $-|(-9)| \times 10 =$

ⓖ $9 \times$ zero = ... ⓗ zero $\times (-8) =$ ⓘ $|-2| \times |-5| =$

Solution

ⓐ -21 ⓑ 70 ⓒ -24

ⓓ -27 ⓔ 20 ⓕ $-9 \times 10 = -90$

ⓖ zero ⓗ zero ⓘ $2 \times 5 = 10$

Check Point

Find the product of each the following:

(a) $12 \times (-7)$ **(b)** $(-3) \times (-8)$ **(c)** zero $\times$ 56 **(d)** $-|(-4)| \times 6$

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Properties of multiplication in ℤ:

a Closure property:

- If $a \in \mathbb{Z}$, $b \in \mathbb{Z}$, then $a \times b \in \mathbb{Z}$

EX. $(-3) \in \mathbb{Z}$, $5 \in \mathbb{Z}$, then $(-3) \times 5 = (-15) \in \mathbb{Z}$

- $\mathbb{Z}$ is closed under multiplication.

i.e. Multiplication in $\mathbb{Z}$ is always possible.

b Commutative property:

- If $a \in \mathbb{Z}$, $b \in \mathbb{Z}$, then $a \times b = b \times a$.

EX. $-3 \in \mathbb{Z}$, $5 \in \mathbb{Z}$, then $(-3) \times 5 = 5 \times (-3) = (-15)$.

i.e. Multiplication is commutative in $\mathbb{Z}$

c Associative property:

- If $a \in \mathbb{Z}$, $b \in \mathbb{Z}$ and $c \in \mathbb{Z}$, then $(a \times b) \times c = a \times (b \times c)$.

EX. $[(-3) \times 5] \times (-2) = (-15) \times (-2) = 30$

$(-3) \times [5 \times (-2)] = (-3) \times (-10) = 30$

i.e. Multiplication is associative in $\mathbb{Z}$

d The multiplicative identity: (or the neutral element)

- If $a \in \mathbb{Z}$, then $a \times 1 = 1 \times a = a$

EX. $3 \times 1 = 1 \times 3 = 3$, $(-3) \times 1 = 1 \times (-3) = -3$, so on.

i.e. 1 is the multiplicative identity element in $\mathbb{Z}$

e Distributive property:

- If a , b and $c \in \mathbb{Z}$, then $a \times (b + c) = a \times b + a \times c$ and $a \times (b - c) = a \times b - a \times c$

EX. Since: $3 \times ((-2) + 7) = 3 \times 5 = 15$

and since: $3 \times (-2) + 3 \times 7 = (-6) + 21 = 15$

Therefore: $3 \times ((-2) + 7) = 3 \times (-2) + 3 \times 7$

Also: $2 \times ((-5) - 3) = 2 \times (-5) - 2 \times 3 = -10 - 6 = (-16)$

i.e. Multiplication is distributed over addition and subtraction in $\mathbb{Z}$

Properties

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Solved Example 2

Use the properties of addition to find:

(a) $(-5) \times 58 \times (-20)$

(b) $(-8) \times (-4) \times (-125) \times (-25)$

Solution

(a) $(-5) \times 58 \times (-20)$

$= (-5) \times (-20) \times 58$ (Commutative)

$= [(-5) \times (-20)] \times 58$ (Associative)

$= 100 \times 58 = 5\,800$

(b) $(-8) \times (-4) \times (-125) \times (-25)$

$= (-8) \times (-125) \times (-4) \times (-25)$ (Commutative)

$= [(-8) \times (-125)] \times [(-4) \times (-25)]$ (Associative)

$= 1000 \times 100$

$= 100\,000$

Check Point

Find the following by using properties of multiplication:

(a) $(-8) \times (4) \times (-125)$ **(b)** $8 \times (-6) \times (-5)$ **(c)** $4 \times 75 \times 25$

REMARK

You can use a calculator to check your answer.

For example:

$(-5) \times 58 \times (-20)$ we press the keys of the calculator as follows:

$-\ 5 \times 58 \times -\ 20 = 5800$



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Solved Example 3

(a) 5 x (–6) + 5 x 5 (b) 10 x 7 + 10 x 13 (c) 15 x 10 – 15 x 20

(d) 15 x (–18) + 135 x (–18) – 50 x (–18) (e) 32 x 18 – 32 x 14 + 32

(f) (–19) x 15 – 15 (g) 25 x –103 (h) – 15 x 99

Solution

(a) 5 x (– 6) + 5 x 5

= 5 x [(– 6) + 5] [distribution prop.]

= 5 x (– 1) = – 5

(b) 10 x 7 + 10 x 13

= 10 x (7 + 13) [distribution prop.]

= 10 x 20 = 200

(c) 15 x 10 – 15 x 20

= 15 x [10 + (– 20)] [distribution prop.]

= 15 x (–10) = – 150

(d) 15 x (–18) + 135 x (– 18) – 50 x (–18)

= (–18) x [15 + 135 – 50] [distribution prop.]

= (–18) x 100 = –1800

(e) 32 x 18 – 32 x 14 + 32

= 32 (18 – 14 + 1) [distribution prop.]

= 32 (5) = 160

(f) (–19) x 15 – 15

= 15 x [(–19) – 1] [distribution prop.]

= 15 x – 20 = –300

(g) 25 x –103

= 25 x [– 100 + (– 3)] [distribution prop.]

= 25 x (–100) + 25 x (– 3)

= – 2500 + (– 75) = – 2575

(h) –15 x 99

= (–15) x [100 + (–1)] [distribution prop.]

= (–15) x 100 + (– 15) x (–1)

= –1500 + 15 = –1485

Check Point

Use the distributive property to find:

(a) 2 × (– 98) **(b)** 4 × 6 – 4 × 7 **(c)** 6 × [– 2 + (– 7)]

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Solved Example 4

(a) Find the result of: 6 x [–2 + (–7)] by using two methods.

(b) Find the result of: 112 x 17 + 112 x (–17) by using two methods.

(c) If a = 8 , b = – 5 and c = 3 , then find the value of:

(a + b) x c by using two methods.

Solution

(a) ***First*** By using dist. prop.

= 6 x [– 2 + (–7)]

= 6 x (– 2) + 6 x (– 7)

= (–12) + (– 42) = – 54

Second without using dist. prop.

= 6 x [– 2 + (– 7)]

= 6 x (– 9)

= – 54

(b) ***First*** By using dis. prop.

= 112 x 17 + 112 x (–17)

= 112 x [17 + (–17)]

= 12 x 0 = 0

Second without using dis. prop.

= 112 x 17 + 112 x (–17)

= 1904 + (–1904) = 0

(c) ***First*** By using dis. prop.

= 8 x 3 + (– 5) x 3

= 24 + (– 15) = 9

Second without using dis. prop.

= (8 + (– 5)) x 3

= 3 x 3 = 9

Check Point

Find the result of each of the following by two methods:

(a) 150 × 12 + 150 × (–13)

(b) 8 × (–110) + 100 × 8

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Second Dividing integers:

The possibility of division in ℤ:

Notice each of the following:

1. The division is the inverse operation of multiplication.

 For example: $(-3) \times 6 = -18$ **then**

 $(-18) \div 6 = -3$ and $(-18) \div (-3) = 6$

2. • The quotient of two integers of same signs is a positive number.
 • The quotient of two integers of different signs is a negative number.

 For example: $36 \div 4 = 9$ and $(-36) \div (-4) = 9$

 and $(-36) \div 4 = -9$ and $36 \div (-4) = -9$

3. Since $5 \div 2 \notin \mathbb{Z}$, $(-16) \div 3 \notin \mathbb{Z}$, so on, then:
 the division is not always possible in ℤ.
 i.e. ℤ is not closed under the division operation.

4. The quotient of "0" by any integer except 0 is 0 while division by 0 has no meaning.
 For example: $0 \div 7 = 0$, $0 \div (-3) = 0$ While $(-2) \div 0$ has no meaning.

Solved Example 5

Find the quotient of each of the following in ℤ if possible:

(a) $54 \div 9 =$ (b) $72 \div (-9) =$ (c) $(-27) \div (-3) =$

(d) $\frac{-45}{5} =$ (e) $0 \div (-6) =$ (f) $(-28) \div 0 =$

Solution

(a) 6 (b) -8 (c) 9 (d) -9 (e) 0 (f) has no meaning

Check Point

Find the quotient of each of the following:

(a) $-35 \div 5 =$ **(b)** $\frac{-6}{2} =$ **(c)** $72 \div (-8) =$

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REMARKS

a Division operation is not commutative in $\mathbb{Z}$.

For example: $4 \div (-2) \neq (-2) \div 4$

Because: $4 \div (-2) = -2$ but $(-2) \div 4$ is impossible in $\mathbb{Z}$.

b Division operation is not associative in $\mathbb{Z}$.

For example: $(16 \div 4) \div 2 \neq 16 \div (4 \div 2)$

Because: $(16 \div 4) \div 2 = 4 \div 2 = 2$ but $16 \div (4 \div 2) = 16 \div 2 = 8$

c The rules of signs for finding the quotient of two integers:

(1) If the signs are the same, then the sign of the quotient is positive.

Same sign

$(+) \div (+) = (+)$ *i.e.* $8 \div 2 = 4$

$(-) \div (-) = (+)$ *i.e.* $(-8) \div (-2) = 4$

(2) If the signs are different, then the quotient is negative.

Different sign

$(+) \div (-) = (-)$ *i.e.* $8 \div (-2) = -4$

$(-) \div (+) = (-)$ *i.e.* $(-8) \div 2 = -4$

Solved Example 6

Find the results of the following:

$(32 \div (-8)) \div 2$ and $32 \div ((-8) \div 2)$

(a) What do you notice?

(b) What does that mean?

Solution

$(32 \div (-8)) \div 2 = (-4) \div 2 = -2$ and $32 \div ((-8) \div 2) = 32 \div (-4) = -8$

(a) The results are not equal.

(b) The division operation is not associative in $\mathbb{Z}$.

Check Point

Find the result of the following, then answer:

$(48 \div (-8)) \div 2$ and $48 \div ((-8) \div 2)$

What do you notice? And what does that mean?

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Solved Example 7

If a = 18 , b = – 3 and c = – 2 , calculate the following:

(a) (a ÷ b) ÷ c

(b) (a × c) ÷ b

(c) (a ÷ c) × b

(d) 3a ÷ bc

Solution

(a) (a ÷ b) ÷ c = [18 ÷ (– 3)] ÷ (– 2) = (– 6) ÷ (– 2) = 3

(b) (a × c) ÷ b = [18 × (– 2)] ÷ (– 3) = (– 36) ÷ (– 3) = 12

(c) (a ÷ c) × b = [18 ÷ (– 2)] × (– 3) = (– 9) × (–3) = 27

(d) 3a ÷ bc = 3 × 18 ÷ [(– 2) (– 3)] = 54 ÷ 6 = 9

Solved Example 8

Find the value of:

$(3x \div y) - 7$, when $x = -3$ and $y = -1$

Solution

The value $= (3x \div y) - 7$

$= \big(3 \times (-3) \div (-1)\big) - 7$

$= \big((-9) \div (-1)\big) - 7$

$= 9 - 7 = 2$

Rania Sayed

Check Point

If a = 4 , b = – 2 and c = – 8, then find the value of each of the following:

(a) (a × c) ÷ b

(b) (c ÷ a) × b

(c) 2 c ÷ a b

(d) $\big(3\ a \div (-2)\big) - 5$

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EXERCISE 4

Multiplying and dividing integers

1 ***Find the result of each of the following:***

a) $(-7) \times 3$

b) $3 \times (-8)$

c) zero $\times (-7)$

d) $(-6) \div 2$

e) $(-5) \times |-4|$ *(Cairo 2019)*

f) $-|-6| \times |-3|$

g) $|-12| \times 9$

h) $|0| \div |5|$

i) $[9 + (-5)] \times (-2)$ *(Cairo 2017)*

j) $(-4) \times [(4) + (-5)]$ *(Damietta 2016)*

k) $28 \div (-7)$

l) $-|-4| \times -|-28|$

m) $(-35) \div 7$

n) $(-24) \div (-8)$

2 ***Choose the correct answer:***

a) $(-36) \div (-4)$ = ... (-9 **or** 9 **or** 6 **or** -6)

b) $(-32) \div 8$ = ... (-4 **or** 4 **or** 8 **or** -8)

c) $72 \div (-6)$ = ... (-12 **or** 12 **or** 6 **or** -6)

d) If $x = -12$, $y = 3$, then $x \div y$ = ... (1 **or** -4 **or** 4 **or** 16)

e) $0 \div (-12)$ = ... (-12 **or** 12 **or** 0 **or** has no meaning)

3 ***Complete the following and mention the property which is used:***

a) $(-15) \times 1$ = ... property

b) $[5 \times (-7)] \times 8$ = ... $\times [(-7) \times 8]$ property

c) $(-8) \times 2 = 2 \times$ property

d) $\times (-2)$ = zero property

e) $(-3) \times [5 +$ $] = (-3) \times$ $+ (-3) \times 2$ property

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4 ***Complete, given that $a \in \mathbb{Z}$, $b \in \mathbb{Z}$ and $c \in \mathbb{Z}$:***

a) b × = a × property

b) (a ×) × c = ... × (b × c) property

c) a × = ... × a = a property

d) a × = ... × a = zero property

e) a × (b + ...) = a × + ... × c property

5 ***Complete the following:***

a) 5 × = zero

b) | – 25 | × = 25

c) The quotient of (– 36) ÷ (– 9) = ...

d) | – 24 | ÷ (–8) = ...

e) If $x = -2$, y = 3, then the value of 4 xy = ...

f) – | – 24 | ÷ = 4

g) (– 5 + 3) ÷ 2 = ...

h) If $\frac{x}{3} = 5$, then x = ...

i) If $x = 6$ and y = 2 , then $\frac{x}{y}$ = ...

j) zero x (–11) = ...

k) 5 × (– 4) = ...

l) | – 3 | + 3 x 5 = ... *(Giza 2019)*

m) (–131) × (– 3) = ...

n) – (– 6) x (– 2) = ...

o) (2 × 15) ÷ (– 5) = ...

p) [(– 32) ÷ (– 4)] ÷ (– 2) = ...

q) 12 – [42 ÷ (– 6)] = ...

r) [48 ÷ (– 6)] + 5 = ...

6 ***Complete the following:***

a) Multiplying any integer by zero equals

b) The product of a negative integer and a positive integer is a integer.

c) The product of two positive integers or two negative integers is a integer.

d) The multiplicative neutral element in $\mathbb{Z}$ is

e) If $x \times y = x$ and $x \neq 0$, then y = ...

f) If $x \times (y + z) = 0$ and $x \neq 0$, then y + z = ...

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7 ***Choose the correct answer:***

a) $(-2) \times (-3) =$ (-6 **or** -5 **or** -1 **or** 6)

b) $-5 \times$ $= 15$ (20 **or** 10 **or** 3 **or** -3)

c) $-7 \times$ $= 0$ (0 **or** 1 **or** 7 **or** 10)

d) $\times -9 = -9$ (0 **or** 1 **or** 9 **or** 10)

e) $\times\ 6 = 8 \times -3$ (8 **or** 4 **or** -3 **or** -4)

f) If $a = 5$, $b = -2$, then $ab =$ (10 **or** -10 **or** 3 **or** -3)

8 ***Write the suitable sign (< , = or >) in :***

a) $25 \times (-4)$		$25 \times \lvert -4 \rvert$
b) -5×100		$-5 \times \lvert -100 \rvert$
c) $\lvert -10 \rvert \times 70$		$30 \times \lvert -10 \rvert$
d) $[27 + (-27)] \times 8$		$[\lvert 15 \rvert + (-16)] \times \lvert -8 \rvert$
e) $(-15) \div 3$		-7
f) $(-48) \div 8$		9
g) (-8)		$(-49) \div 7$
h) $(-63) \div 9$		$18 \div 3$
i) $72 \div 8$		$\lvert -80 \rvert \div 10$
j) $\lvert -35 \rvert \div 5$		$49 \div \lvert -7 \rvert$
k) $(-66) \div \lvert -6 \rvert$		$30 \div 5$
l) $\lvert -81 \rvert \div 9$		$\lvert -54 \rvert \div 6$

9 ***Find the value of x in each of the following (Where $x \in \mathbb{Z}$):***

a) $8 \times x = -48$

b) $x \times 9 = -45$

c) $x \times 9 = (-72)$

d) $(-2) \times 4 = x \times (-2)$

e) $x \times [5 \times (-13)] = [(-9) \times 5] \times (-13)$

f) $x \times (7 \times 8) = [(-9) \times 7] \times 8$

g) $x \times (3 + 5) = (-12) \times 3 + (-12) \times 5$

h) $5 \times \lvert -17 \rvert = 5 \times (x + 7)$

i) $2 \lvert x \rvert = 6$

j) $5 \times \lvert -7 \rvert = 5 \times \lvert x + 1 \rvert$

k) $-7x = 28$

l) $(-32) \div x = -4$

m) $\lvert x \div (-2) \rvert = 8$

n) $x \times (9 + 5) = [(-4) \times 9] + [(-4) \times 5]$

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10 ***Use the properties of multiplication in Z to find:***

a) $4 \times (-16) \times 25$ b) $50 \times (-27) \times 2$

c) $-5 \times 77 \times 20$ d) $2 \times 125 \times (-5) \times 8$

11 ***Use the distributive property to find:***

a) $4 \times (-3) + 4 \times 5$ b) $(-6) \times (-7) + 2 \times (-6)$

c) $143 \times 69 - 43 \times 69$ d) $115 \times 98 + 115 \times (-97)$

e) $102 \times 15 + 102 \times (-15)$ f) $35 \times 18 - 35 \times 34 + 35 \times 17$

g) 34×102 h) 24×97

i) 54×113 j) $(-14) \times 99$

12 ***Find the result of each of the following in two methods:***

a) $(-7) \times (17 + 3)$ b) $15 \times (8 - 18)$

c) $6 \times [(-2) + (-7)]$ d) 📖 $6 \times [(-6) + 0]$

e) $[(-5) + 3] \times 10$ f) $[8 + (-5)] \times 6$

g) 📖 $(-4) + [4 + (-1)]$ h) 📖 $[5 + (-3)] \times (-11)$

Cumulative Exercise

13 ***First: If $a = 21$, $b = -3$ and $c = 7$, calculate the value of each of the following:***

a) $(a \div b) \times c$ b) $(b \times c) \div a$

c) $a \div (c \times b)$ d) $(2a \div 7) \div b$

Second: a) If $x = 2$, $y = 1$ and $z = 5$, find the value of: $3x - 2y + z$

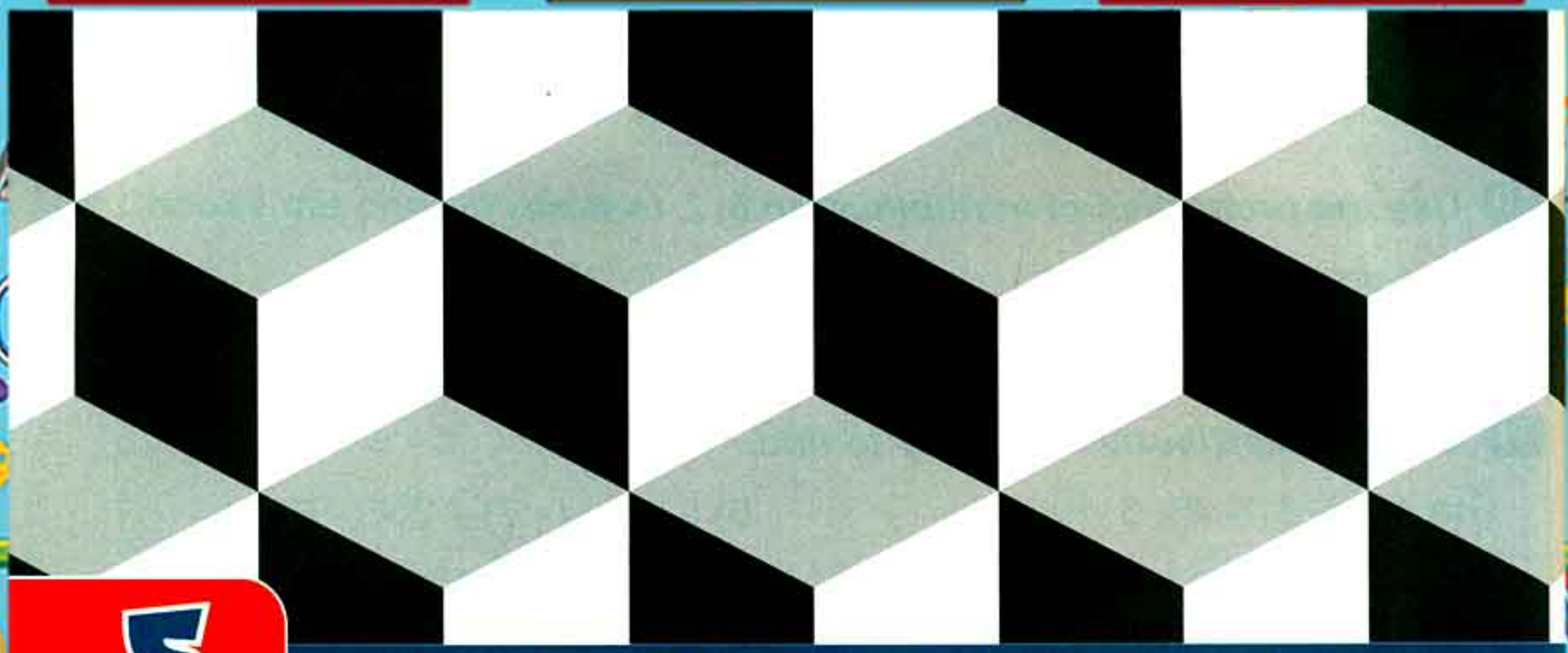
b) If $x = 3$, $y = -1$ and $z = -2$, find the value of: $(2x \div y) \times 3z$

c) If $x = 8$, $y = -2$, find the value of: $x - 2y \div 4$

THINK AND EXPLORE

14 If $x \in \mathbb{Z}$ and $3|x| \div (-2) = x - 5$, ***then find the value of*** x.

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Lesson 5

REPEATED MULTIPLICATION

Aims

At the end of this lesson, you will be able to:

(1) recognise the concept of repeated multiplication.

(2) apply the law of adding power in multiplication and the law of subtracting power in division.

watch video

WARM UP

Mai is a good pupil.

She asked her elder brother Ahmed.

What is the meaning of:

Repeated multiplication?



Ahmed said, "Do you remember Mai the meaning of repeated addition?"

Mai answered, "Yes, Ahmed. I can write that as:

$2 + 2 + 2 = 2 \times 3 = 6$"



Ahmed: Repeated multiplication is like that as:

$2 \times 2 \times 2$ and I can write that as:

$2 \times 2 \times 2 = 2^3$

and that is equal to $2 \times 2 \times 2 = 8$

$= 4$ $= 8$

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The concept of repeated multiplication:

Multiplying a number by itself many times is known as (repeated multiplication).

For example:

2 x 2 x 2 means that 2 is multiplied by itself three times.

- It is written as: Power → 2^3 ← Base

 and is read as 2 to the power 3 (or 2 is raised to the power 3)
- The number 2 is called the base and 3 is called the power or exponent or index.

In general

$\underbrace{a \times a \times a \times \cdots\cdots \times a}_{\text{n–times}} = a^n$ where $a \in \mathbb{Z}$, $n \in \mathbb{Z}^+$

REMARKS

a. If the base is a negative integer raised to an even power, then the result is positive.
 EX. $(-2)^2 = (-2) \times (-2) = 4$ and $(-2)^4 = (-2) \times (-2) \times (-2) \times (-2) = 16$
b. If the base is a negative integer raised to an odd power, then the result is negative.
 EX. $(-2)^3 = (-2) \times (-2) \times (-2) = -8$
 and $(-2)^5 = (-2) \times (-2) \times (-2) \times (-2) \times (-2) = -32$
c. Any number to the first power = the number itself
 EX. $(7)^1 = 7$, $(-12)^1 = -12$, so on.
d. The second power of any number is called the square of the number
 EX. 5^2 is read as (5 square) which is = 25
e. The third power of any number is called the cube of the number
 EX. 5^3 is read as (5 cube) which is = 125

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Solved Example 1

Find the result of each of the following:

(a) $(-2)^5$ (b) $(-3)^4$ (c) $(-1)^{10}$ (d) $(-1)^{25}$

Solution

(a) $(-2)^5 = -2^5 = -(2 \times 2 \times 2 \times 2 \times 2) = -32$

(b) $(-3)^4 = 3^4 = 3 \times 3 \times 3 \times 3 = 81$

(c) $(-1)^{10} = 1^{10} = 1$

(d) $(-1)^{25} = -1^{25} = -1$

Check Point

Choose the correct answer:

(a) $(-7)^3$ = ... (343 *or* -334 *or* -343 *or* 300)

(b) $(3)^3$ = ... ($(-3)^3$ *or* 9 *or* 27 *or* 6)

(c) $(-9)^2$ = ... (18 *or* -18 *or* 81 *or* -81)

REMARK

Use a calculator to check your answer.



For example:

To calculate $(-3)^4$, follow: (− 3) $\times^{\square}$ 4 = 81

Solved Example 2

If a = 2 and b = –1, find the value of:

(a) $a^3 + b^2$ (b) $a^4 + b^3$ (c) $(a-b)^2$

Solution

(a) $a^3 + b^2 = 2^3 + (-1)^2 = 8 + 1 = 9$

(b) $a^4 + b^3 = 2^4 + (-1)^3 = 16 - 1 = 15$

(c) $(a-b)^2 = (2-(-1))^2 = (2+1)^2 = 3^2 = 9$

Check Point

If a = 3 , b = –1 and c = 2 , *find the value of each of the following:*

(a) $a^2 + c^3$ = ... **(b)** $a^2 - 2ab$ = ... **(c)** $(a-b)^c$ = ...

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The basic laws of repeated multiplication:

First Law: Adding powers in multiplication:

$\because \quad 7^2 \times 7^3 = (7 \times 7) \times (7 \times 7 \times 7) = 7^5$

i.e. $7^2 \times 7^3 = 7^{2+3} = 7^5$

So, $a^m \times a^n = a^{m+n}$, $a \in \mathbb{Z}$ and $m \in \mathbb{Z}^+$, $n \in \mathbb{Z}^+$ [keep the base and add powers]

Second Law: Subtracting powers in division: [When the bases are equal]

$\because \quad \frac{2^7}{2^3} = \frac{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2}{2 \times 2 \times 2} = 2^4$

i.e. $\frac{2^7}{2^3} = 2^{7-3} = 2^4$

So, $\frac{a^m}{a^n} = a^{m-n}$, $a \in \mathbb{Z} - \{0\}$, $m \in \mathbb{Z}^+$, $n \in \mathbb{Z}^+$ and $m > n$ [keep the base and subtract powers]

Note that

- By using the previous rules, we can calculate that:

$(-3)^3 \times (-3)^5 = (-3)^8$, $\frac{(-3)^8}{(-3)^5} = (-3)^3$

- $\because \frac{a^n}{a^n} = 1$ $\quad \therefore a^0 = 1$ such that $a \neq 0$

So, for every $a \in \mathbb{Z} - \{0\}$, then $a^0 = 1$

Solved Example 3

Find the result of each of the following:

(a) $3^2 \times 3^2$ (b) $\frac{5^3 \times 5^4}{5^5}$ (c) $\frac{(-2)^3 \times (-2)^7}{(-2)^2 \times (-2)^4}$

Solution

(a) $3^2 \times 3^2 = 3^{2+2} = 3^4 = 81$

(b) $\frac{5^3 \times 5^4}{5^5} = \frac{5^{3+4}}{5^5} = \frac{5^7}{5^5} = 5^{7-5} = 5^2 = 25$

(c) $\frac{(-2)^3 \times (-2)^7}{(-2)^2 \times (-2)^4} = \frac{(-2)^{3+7}}{(-2)^{2+4}} = \frac{(-2)^{10}}{(-2)^6} = (-2)^{10-6} = (-2)^4 = 16$

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Check Point

Calculate:

(a) $4^4 \times 4^4 =$

(b) $\frac{10^5 \times (-10)^4}{10} =$

(c) $\frac{(-5)^3 \times (-5)^6}{(-5)^2 \times (-5)^4} =$

(d) $\frac{4^9}{4^5} \times 4^4 =$

Solved Example 4

Put each of the following in the simplest form:

(a) $\frac{x^5 \times x \times x^3}{x^7 \times x} =$, $x \neq$ zero

(b) $\frac{a^5 \times a^3}{a \times a^4} =$, $a \neq$ zero

(c) $3^6 + 3^4 =$

(d) $\frac{(-5)^3}{(-5)^2} + \frac{(-3)^3}{3^2} =$

Solution

(a) $\frac{x^5 \times x \times x^3}{x^7 \times x} = \frac{x^{5+1+3}}{x^{7+1}} = \frac{x^9}{x^8} = x^{9-8} = x^1 = x$, $(x \neq 0)$

Note that

$3^6 + 3^4 \neq 3^{10}$

Why?

(b) $\frac{a^5 \times a^3}{a \times a^4} = \frac{a^{5+3}}{a^{1+4}} = \frac{a^8}{a^5} = a^{8-5} = a^3$, $(a \neq 0)$

(c) $3^6 + 3^4 = 3^2 \times 3^4 + 3^4 = 9 \times 3^4 + 3^4 = 3^4 \times (9 + 1) = 3^4 \times 10 = 81 \times 10 = 810$

(d) $\frac{(-5)^3}{(-5)^2} + \frac{(-3)^3}{3^2} = (-5)^{3-2} - \frac{3^3}{3^2} = (-5)^1 - 3^1 = -5 - 3 = -8$

Check Point

Find the result of each of the following:

a) $\frac{x^4 \times x^3 \times x^2}{x^4 \times x} =$, $x \neq 0$

b) $\frac{a^6 \times a^7}{a^8 \times a^5} =$

c) $5^2 + (-3)^2 =$

d) $\frac{(-3)^4}{(-3)^2} + \frac{(-5)^3}{5^2} =$

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EXERCISE 5

Repeated multiplication

1 ***Find the value of each of the following:***

a) 2^5 = ...
b) 3^3 = ...
c) $(-4)^3$ = ...
d) $(-9)^2$ = ...
e) $(-8)^{zero}$ = ...
f) $(-1)^{35}$ = ...
g) $(-1)^{24}$ = ...
h) 5 cubed = ...
i) 7 squared = ...
j) 2 to the third power = ...

2 ***Choose the correct answer:***

a) $(-7)^3$ = ... (-343 **or** 343 **or** -21 **or** 21)
b) $(-9)^2$ = ... (-18 **or** 18 **or** 81 **or** -81)
c) $(-35)^{zero}$ = ... (35 **or** 15 **or** 1 **or** -35)
d) $(-2)^5$ = ... (-10 **or** 10 **or** -25 **or** -32)
e) $(-2)^4$ = ... (8 **or** -8 **or** 16 **or** -16)
f) $(-1)^3 + 1^3$ = ... (-3 **or** -2 **or** -1 **or** zero)
g) $(-8)^{zero} + (8)^{zero}$ = ... (-1 **or** 1 **or** 2 **or** zero)
h) $(-2)^4 <$ ($(-1)^8$ **or** $(-2)^5$ **or** 3^3 **or** $-(3)^5$)
i) $(-2)^2$ $\mathbb{Z}$ ($\in$ **or** $\notin$ **or** $\subset$ **or** $\not\subset$)
j) The additive inverse of $(-1)^3$ is (1 **or** -1 **or** 3 **or** -3)
k) $2^6 \times 2^2 \div 2^7$ = ... (2^8 **or** 2^{12} **or** 2^5 **or** 2)
l) $4^3 - 4^2$ = ... (4 **or** 4^5 **or** 4^6 **or** 48)
m) $(-1)^{104} + (-1)^{103}$ = ... (zero **or** -1 **or** 1 **or** 2)
n) $(-5)^{zero} \times (-3)^2$ = ... (3 **or** 4 **or** 5 **or** 9)
o) If $2^5 \div 2^a = 3^0$, then a = ... (4 **or** 5 **or** -5 **or** 0)
p) If $x = 1$, $y = -2$, then the negative number in the following is
($x + y^2$ **or** $x^2 - y$ **or** $x^2 + y$ **or** $x^2 + y^2$)

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3 ***Find the value of each of the following:***

a) $x^3 \times x^2 \times x$

b) $5^2 \times 2^3$

c) $(-4)^3 \div (-2)^4$

d) $(-6)^{12} \div 6^{10}$

e) $|(-3)^3| \div 27$

f) $3 \times (-2)^5$

g) 📖 $(-7)^2$

h) 📖 $(-5)^2 \times 2^2$

i) 📖 $(-2)^4 + (-3)^3$

j) 📖 $(-1)^{100} + (-1)$

4 ***Complete each of the following:***

a) $\frac{3^5 \times 3^2}{3^3} = \frac{3^{....}}{3^{....}} = 3^{...} =$

b) $\frac{2^7 \times 2^8}{2^8 \times 2^5} = \frac{2^{....}}{2^{....}} = 2^{....} =$

c) $\frac{(-5)^5 \times (-5)^2}{(-5)^3 \times (-5)} = \frac{(-5)^{....}}{(-5)^{....}} = (-5)^{....} =$

d) $\frac{a \times a^5 \times a^6}{a^2 \times a^8} = \frac{a^{....}}{a^{....}} = a^{....}$ $(a \neq 0)$

5 ***Find the value of each of the following:***

a) $\frac{(3)^4 \times (3)^7}{(3)^5 \times (3)^3}$

b) 📖 $\frac{2^6 \times 2^5}{2^3 \times 2}$

c) $\frac{(-2)^6 \times 2^4}{2^9}$

d) 📖 $\frac{(-3)^3 \times (-3)^4}{(-3)^5}$

e) 📖 $\frac{(-8)^3 \times 8^4}{(-8)^7}$

f) 📖 $\frac{9^6 \times (-9)^3}{(-9)^5 \times 9^2}$

g) $\frac{(-3)^6}{(-3)^3} + \frac{(-4)^5}{(-4)^3}$

h) $\frac{(-8)^5}{(8)^3} \times (-7)^{zero}$

i) $\frac{(-9)^5}{(9)^4} \times 9^2$

6 ***Put the suitable sign (< , = or >) in each :***

a) 📖 4^2 8

b) $(-3)^4$ $(-3)^5$

c) 2^4 4^2

d) 📖 $(-6)^2$ -12

e) $(-27)^{zero}$ 1

f) $(-4)^3$ $(-2)^6$

g) 📖 $(9)^2$ $(-3)^4$

h) 📖 $\frac{1}{7^5} \times 7^5$ 1

i) $2^3 + 2^2$ $2^2 \times 2^3$

j) $(-2)^4 + (-3)^2$ 25

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7 ***Arrange the following numbers:***

a) 3^2, $(-1)^3$ and $(25)^{zero}$ (ascendingly)

b) $(-2)^5$, $(-3)^2$, $(-4)^0$, $(-1)^{15}$ and $(-3)^3$ (ascendingly)

c) $(-2)^3$, $(-3)^2$, $(-1)^7$ and $(-5)^2$ (descendingly)

d) 10^2, $(-1)^5$, 100^2, $(-10)^3$ and 100000 (descendingly)

8 ***Use the distributive property to find the value of:***

a) $(18)^2 + 18 \times 12$ b) $112 \times 17 + 112 \times (-17)$ c) $(24)^2 + 24 \times 77 - 24$

9 ***If a = –2, b = –1 and c = 3, find the value of:***

a) $a^2 + b^2$ b) $(a + b)^3$

10 ***Simplify each of the following to the simplest form:***

a) $\frac{x^9}{x^4 \times x^5}$, where $(x \neq 0)$ b) $\frac{x \times x^2 \times x^8}{x^3 \times x^7}$, where $(x \neq 0)$

c) $\frac{x^5 \times y^4}{y^4 \times x^4}$, where $(x \neq 0, y \neq 0)$ d) $\frac{a^{13}}{a^8 \times a^3}$, where $(a \neq 0)$

Cumulative Exercise

11 ***Use the distributive property to calculate the value of each of the following:***

a) $15^2 + 15 \times 25$ b) $44 \times 24 - (24)^2$

c) $(18)^2 + 18 \times 83 - 18$ d) $(-4)^3 \times 5 - (-4)^3 \times 2$

THINK AND EXPLORE

12 If $a = 3^2$, $b = 2^3$, ***find the value of*** $(a - b)^{10}$.

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Lesson 6

NUMERICAL PATTERNS

Aims

At the end of this lesson, you will be able to:

(1) deduce the concept of the numerical pattern.

(2) identify Pascal's triangle.

(3) describe the rules of some different patterns.

WARM UP

watch video

- The ancient Egyptian pharaoh Zoser constructed a step pyramid by using stones, these stones are represented by the opposite pattern.



- Also in numbers there are many numerical patterns

 as: 1 , 2 , 3 , 4 , 5 , ...

 or: 0 , 2 , 4 , 6 , 8 , ...

 or: 1 , 3 , 5 , 7 , 9 , so on.

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First Numerical patterns:

Definition:

The numerical pattern: is a sequence of numbers arranged according to a particular rule.

For example:

- The set of numbers { 1, 2, 3, 4, ... } is a numerical pattern,

 its rule is "each number is more than its predecessor (or previous) by (1)".

- The set of numbers { 100, 95, 90, 85, ... } is a numerical pattern,

 its rule is "each number is less than its predecessor (or previous) by 5."

Definition:

Describing the pattern: means discovering the rule of the pattern and expressing it in words.

Note that

1. The natural numbers (ℕ): 0, 1, 2 , 3, 4, ... represent a numerical pattern and its description is "each number is more than its previous number by one starting from"0" "
2. The set of odd numbers (◎): 1, 3, 5, 7, 9, ... represents a numerical pattern and its description is "each number is more than its previous number by 2 starting from "1" "
3. The set of even numbers (𝔼): 0, 2, 4, 6, 8, 10 represents a numerical pattern and its description is "each number is more than its predecessor by 2 starting from "0".

rule قاعدة | predecessor سابق

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Solved Example 1

Discover the rule of the numerical pattern, then complete in the same pattern:

(a) 0, 4, 8, 12, ... , ... , ...

(b) 128, 118, 108, 98, ... , ... , ...

(c) 1, 3, 9, 27, ... , ... , ...

(d) 1, – 2, 4, – 8, ... , ... , ...

(e) 256, 128, 64, 32 , ... , ... , ...

Solution

(a) +4 +4 +4 +4 +4 +4

0 , 4 , 8 , 12 , 16 , 20 , 24

The rule: each number is more than its previous by 4.

(b) –10 –10 –10 –10 –10 –10

128 , 118 , 108 , 98 , 88 , 78 , 68

The rule: each number is less than its previous by 10.

(c) x3 x3 x3 x3 x3 x3

1 , 3 , 9 , 27 , 81 , 243 , 729

The rule: each number is the product of multiplying its previous by 3.

(d) x(–2) x(–2) x(–2) x(–2) x(–2) x(–2)

1 , –2 , 4 , –8 , 16 , –32 , 64

The rule: each number is the product of multiplying its previous by –2.

(e) ÷ 2 ÷ 2 ÷ 2 ÷ 2 ÷ 2 ÷ 2

256 , 128 , 64 , 32 , 16 , 8 , 4

The rule: each number is the quotient of its previous by 2.

Check Point

Complete in the same pattern:

(1) 768 , 384 , 192 , 96

(2) 1 , – 3 , 9 , – 27 , 81 , ...

(3) $\frac{1}{2}$, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{16}$, ...

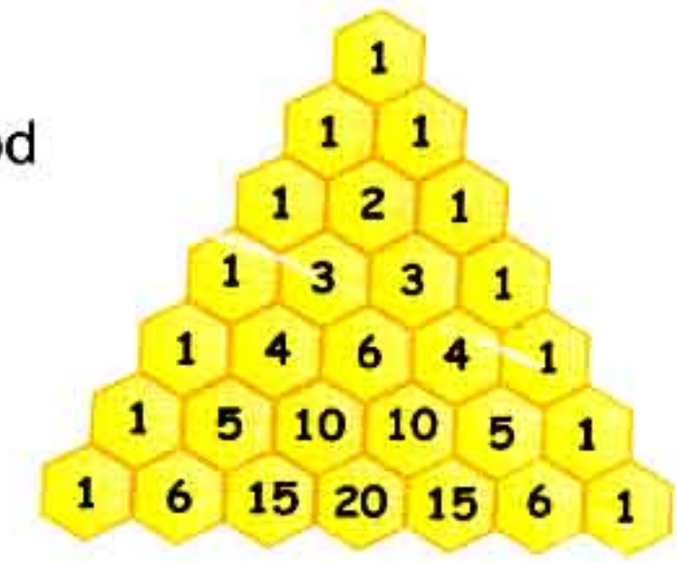
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Second Pascal's triangle:

Pascal's triangle is one of the well-known numerical patterns

It was discovered by the French physicist and mathematician "Blaise Pascal" who lived in the period (1623 – 1662).



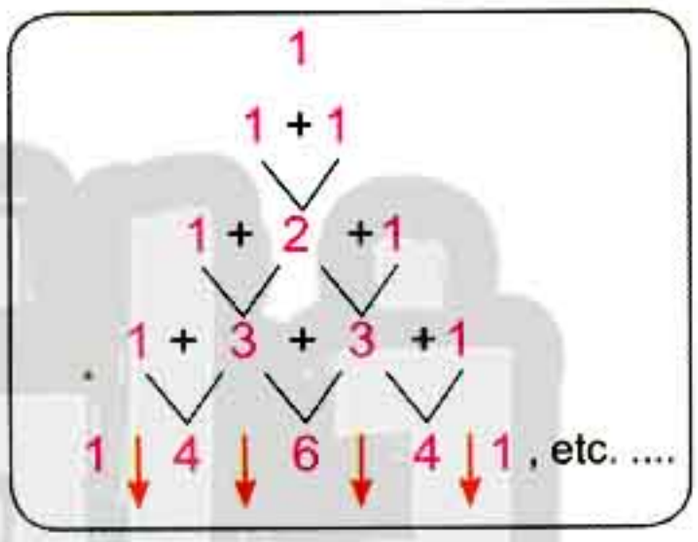
1. The opposite figure is called Pascal's triangle

In this triangle the rule is:

- Each row begins and ends with (one).

and

- After the second row, we find that each number represents the sum of the two numbers directly above it, as shown in the chart.



2. There are a lot of numerical patterns that we can get from Pascal's triangle such as:

a) The sum of numbers of the rows are:

1 , 1 + 1 , 1 + 2 + 1 , 1 + 3 + 3 + 1 , ...

i.e. 2^0 , 2^1 , 2^2 , 2^3 , ...

which represents the numerical pattern 1, 2, 4 , 8 , 16 , 32 , 64 , ...

b) The diagonals represent the numerical patterns:

(1) 1 , 1 , 1 , 1 , ...

(2) 1 , 2 , 3 , 4 , 5 , 6 , ...

(3) 1 , 3 , 6 , 10 , 15 , ...



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Solved Example 2

Complete in the same pattern:

ⓐ



1 3 6 10 , ...

(Numbers are called triangular numbers.)

ⓑ

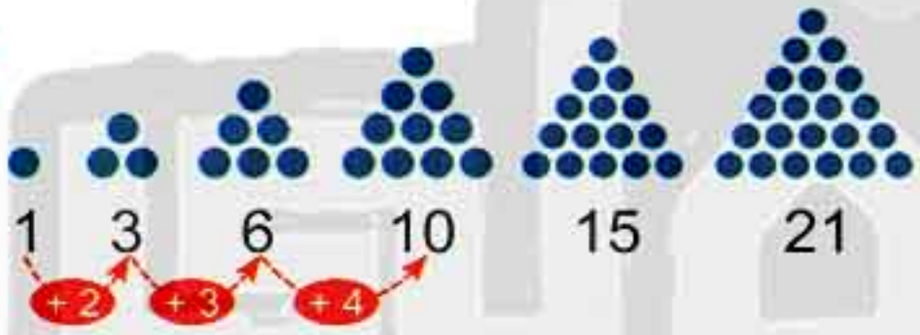


1 4 9 16 , ...

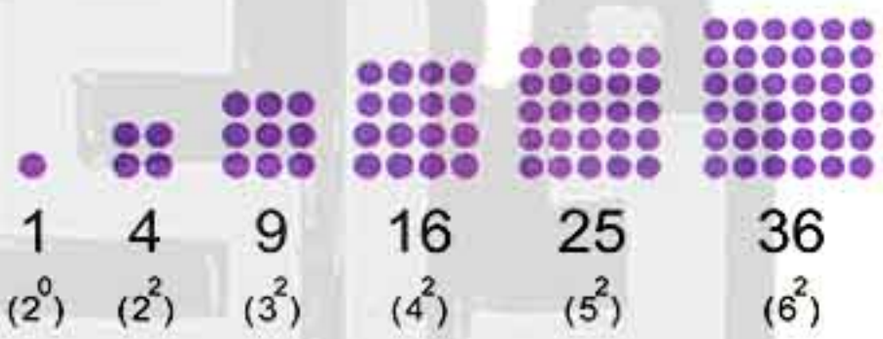
(Numbers are called perfect square numbers.)

Solution

ⓐ

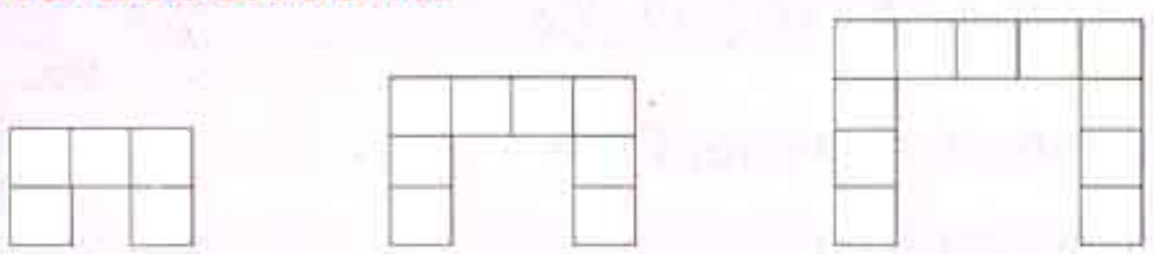


ⓑ



Check Point

Write the number of squares below each shape, then write the numerical pattern and describe it:



Number of squares:

The numerical pattern: , ... , ...

Description of the pattern:

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EXERCISE 6 Numerical patterns

1 ***Complete in the same pattern:***

a) 1 , 3 , 5 , 7 , ... , ... , ... , ... , ...

b) 1 , 4 , 7 , 10 , ... , ... , ... , ... , ...

c) – 2 , zero , 2 , 4 , ... , ... , ... , ... , ...

d) 16 , 12 , 8 , 4 , ... , ... , ... , ... , ...

e) – 20 , – 18 , – 16 , ... , ... , ... , ... , ...

f) 7 , 3 , – 1 , ... , ... , ... , ... , ...

g) 243 , 81 , 2 7 , ... , ... , ... , ... , ...

h) $\frac{1}{3}$, $\frac{1}{6}$, $\frac{1}{12}$, ... , ... , ... , ... , ... *(Behera 2017)*

2 ***Complete in the same pattern by writing three consecutive numbers:***

a) 50 , 46 , 42 , 38 , ... , ... , ... *(Cairo 2016)*

b) – 15 , – 12 , – 9 , ... , ... , ...

c) 3 , 9 , 27 , 81 , ... , ... , ...

d) 6 , 14 , 22 , 30 , 38 , ... , ... , ...

e) $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$, ... , ... , ...

f) 2 , 3 , 5 , 8 , 13 , ... , ... , ...

g) 1 , 4 , 9 , 16 , 25 , ... , ... , ...

h) 0 , 1 , 8 , 27 , 64 , ... , ... , ...

i) – 4 , 0 , 4 , ... , ... , ...



3 ***Complete each of the following patterns:***

a) $1\frac{1}{4}$, 1 , $\frac{3}{4}$, ... , ... , ...

b) 12 , 18 , 24 , ... , ... , ...

c) 4, 8 , 12 , 16 , ... , ... , ...

d) 3 , 5 , 7, 9 , 11 , ... , ... , ...

e) 1 , 3 , 6 , 10 , 1 5, ... , ... , ...

f) – 35 , – 30 , – 25 , ... , ... , ...

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4 ***Discover the rule of the numerical patterns, then write the missing numbers:***

a) 0.5 , 1 , ... , 2 , 2.5 , ... , ...

b) 128 , 64 , ... , 16 , 8 , ... , ...

c) 7 , ... , 15 , 19 , 23 , ... , ...

d) , 15 , 12 , 9 , ... , ...

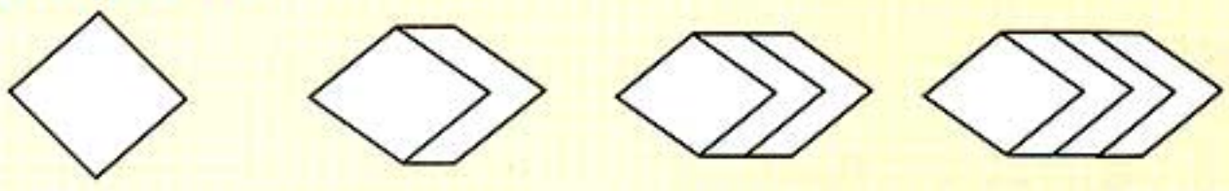
e) , ... , 35 , 29 , 23 , ...

f) 4 , 7 , ... , 13 , 16 , ... , ...

5 ***Complete the following table:***

	The numerical pattern	Description of the pattern
a)	75 , 70 , 65 , 60	
b)	36 , 32 , 28 , ... , ...	Each number is less than its predecessor by 4.
c)	1 , 10 , 100 , 1000	
d)	4 , 8 , 16 , ... , ...	Each number is twice its predecessor.
e)	3 , 7 , 11 , 15 , 19	
f)	4, ... , ... , ... , ...	Each number is more than its predecessor by 5.
g)	$\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, 1 , $\frac{5}{4}$	
h)	3 , 9 , 27 , 81 , ...	
i)	34 , ... , ... , ... , ...	Each number is less than its predecessor by 3.

6 ***Write the number of line segments below each shape, then write the numerical pattern and its description:***



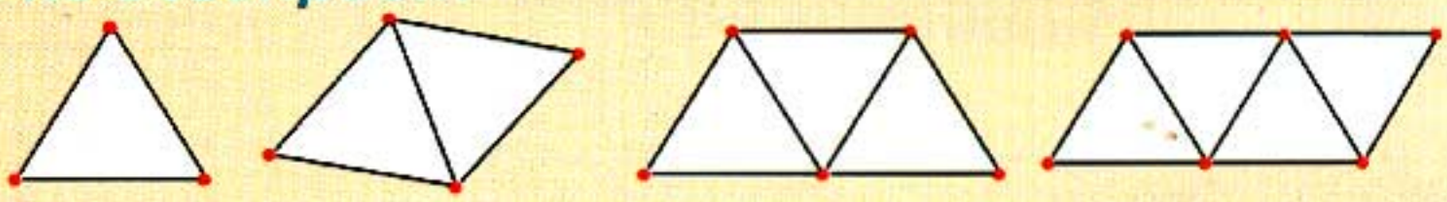
The number of line segments:

The numerical pattern:

Description of the pattern:

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7 📖 ***Write the number of triangles below each shape, then write the numerical pattern and its description:***



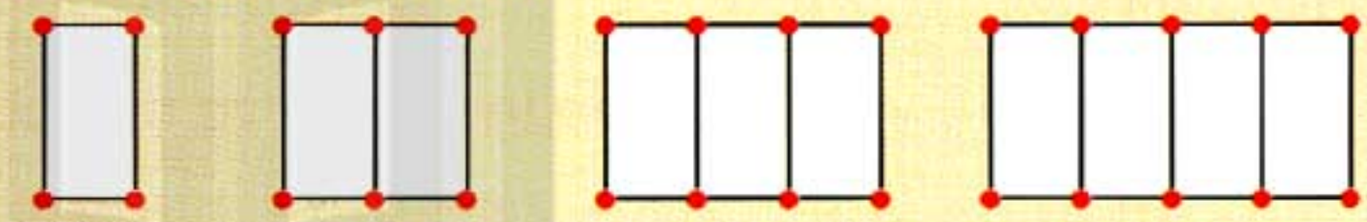
The number of triangles:

The numerical pattern:

Description of the pattern:

Using the number of line segments, write another pattern and describe it.

8 📖 ***Deduce the rule of the pattern that expresses each of the following designs, then write the numerical pattern:***

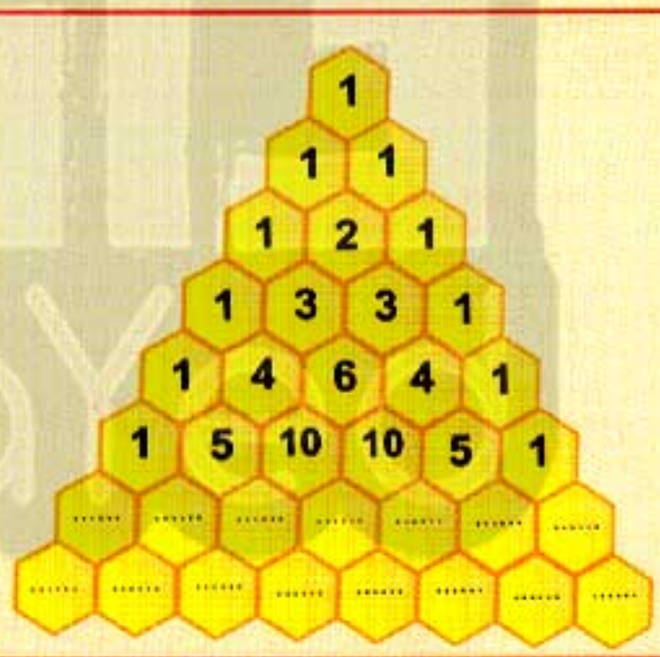


The number of line segments:

The numerical pattern:

The rule of the numerical pattern:

9 📖 ***Copy the opposite Pascal's triangle in your answer sheet and complete the next two rows:***



10 An Egyptian agricultural company reclaims 6 feddans per day making them prepared and ready for agriculture:

How many days does the company need to reclaim 54 feddans?

Write the numerical pattern which expresses this and describe it.

11 Hamada decided to lose weight at the rate of 5 kg monthly. If he is 85 kg heavy right now, how many months does he need to reach 55 kg?

Write the numerical pattern which expresses this and describe it.

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Selected problems from previous exams

1 on Unit

1 Choose the correct answer:

1) $|-5|+3$ $\mathbb{Z}$ ($\in$ or $\notin$ or $\subset$ or $\not\subset$) *(Alexandria 2016)*

2) $\frac{1}{3^5} \times 3^7$ = ... (3^2 or 3^{-2} or 3^{12} or 3) *(Giza 2019)*

3) $(-1)^{105} + (-1)^{20}$ = ... (2 or 1 or –1 or zero) *(Qalubia 2016)*

4) $\mathbb{Z} - \mathbb{N}$ = ... ($\mathbb{N}$ or $\varnothing$ or $\mathbb{Z}^+$ or $\mathbb{Z}^-$) *(Giza 2019)*

5) $\varnothing$ $\{a , b\}$ ($\in$ or $\notin$ or $\subset$ or $\not\subset$) *(Cairo 2019)*

6) If $x = -1$, $y = -2$, then the negative number in the following is
($x + y^2$ or $x^2 + y$ or $x^2 - y$ or $x^2 + y^2$) *(Gharbia 2016)*

7) The additive inverse of $(-5)^2$ = ... (– 25 or 5 or 25 or – 5) *(Cairo 2019)*

8) $\left|\frac{5-11}{3}\right|$ $\mathbb{Z}$ ($\in$ or $\notin$ or $\subset$ or $\not\subset$) *(Giza 2019)*

9) An integer number included between – 2 and 3 is
(3 or – 3 or – 4 or – 1) *(Giza 2017)*

10) If $x \times [7 - (-2)] = (-8 \times 9) \times (-1)$, then x = ...
(63 or – 63 or – 8 or 8) *(Alexandria 2017)*

11) The multiplicative identity in $\mathbb{Z}$ added to 99 = ...
(0 or 1 or 99 or 100) *(Menofia 2016)*

12) $\left|\frac{1}{3}\right| - \left|-\frac{1}{3}\right|$ $\mathbb{Z}$ ($\in$ or $\notin$ or $\subset$ or $\not\subset$) *(Alexandria 2019)*

13) $(-1)^3 - 1$ = ... (– 2 or 0 or 1 or 2) *(Cairo 2017)*

14) $2 - (-3)^0$ (6 or 3 or 1 or – 1) *(Dakahlia 2019)*

15) $(-1)^8 + (-1)^9$ = ... (zero or 1 or – 1 or 2) *(Menofia 2019)*

16) $(-5)^{zero} \times (-3)^2$ = ... (4 or 9 or 10 or – 8) *(Menofia 2015)*

17) $(-1)^3 \times (1)^3$ = ... (2 or 1 or 0 or – 1) *(Dakahlia 2015)*

18) $\frac{6^4 \times 6^5}{6^7}$ = ... (6^2 or 6^6 or 6 or 6^3) *(Alexandria 2019)*

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2 Complete the following:

1) The solution set of the equation $2x - 1 = |-5|$ is *(Gajrboa 2017)*

2) If a , b , c $\in \mathbb{Z}$, then a x (b + c) = a x b + a x c (..... property) *(Suez 2017)*

3) If $2x = 6$, $x \in \mathbb{Z}$, then $x - 1$ = ... *(Cairo 2019)*

4) If $x = |-12|$ and y = – 3 , then $x \div y$ = ... *(Giza 2017)*

5) $\mathbb{Z} - \mathbb{Z}^-$ = ... *(Ismailia 2017)*

6) $-3^2 + 1$ = ... *(Dakahlia 2016)*

7) The additive inverse of $(-3)^2$ is *(Giza 2019)*

8) $(-4)^9 \div (-4)^7$ = ... *(Behera 2017)*

9) The ascending order of the numbers:

– 9 , 17 , | – 9 | , – 15 , 16 is *(Alexandria 2016)*

10) 2 , 3 , 5 , 8 , 13 , ... in the same pattern. *(Qalubia 2013)*

11) (– 8) + 7 = 7 + (– 8) (..... property) *(Qena 2019)*

12) If A = 3 , B = – 2 , then 2 AB = ... *(Sohag 2019)*

13) The smallest non-negative integer is *(Damieta 2016)*

14) $3^2 + 3^2 + 3^2 = 3^{\cdots}$ *(Behera 2016)*

15) $\frac{1}{3}$, $\frac{2}{3}$, 1 , $\frac{4}{3}$, ... , ... in the same pattern. *(Kafr El-Sheikh 2015)*

16) $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, 1 , $\frac{5}{4}$, ... , ... in the same pattern. *(Sharkia 2015)*

17) 3 , 7 , 11 , 15 , ... , ... in the same pattern. *(Menia 2015)*

18) 7 , 10 , 13 , ... , ... in the same pattern. *(Assuit 2017)*

19) $(-19)^{zero} + (19)^{zero}$ = ... *(Fayoum 2017)*

20) 7 , 3 , – 1 , ... , ... in the same pattern. *(Damitta 2015)*

21) The descending order of – 9 , 2 , 5 , – 12 is *(Qalubia 2016)*

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3 ***Find the result of each of the following:***

1) Find the value of: $\frac{(3)^2 \times (3)^5}{(-3)^6}$ *(Sohag 2019)*

2) Find the value of: $\frac{(-3)^4 \times (-3)^5}{(-3)^6 \times (-3)}$ *(Cairo 2019)*

3) Find the value of: $\frac{2^4 \times 2^3}{2^5}$ (in the simplest form) *(Suez 2017)*

4) Find the value of: $\frac{(-2)^5 \times (-2)^2}{(-2)^4}$ *(Ismailia 2017)*

5) Find the value of: $\frac{7^4 \times 7^5}{7^7}$ *(Giza 2016)*

6) Find the value of: $\frac{(2)^5 \times (-2)^3}{(-2) \times (2)^4}$ *(Alexandria 2016)*

7) Use the properties of addition in $\mathbb{Z}$ to find the result of:

$(-116) + 190 + 116$ (state the property used in each step)

(Assuit 2019) , (Alexandria 2019)

8) $(-6) \times [(-3) + 2]$ *(Damitta 2019)*

9) $\frac{(3)^6}{(3)^3} + \frac{(-2)^5}{(-2)^4}$ *(Gharbia 2013)*

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Unit Test 1
(From the School Book)
on Unit

Total mark / 35

1 Complete each of the following: / 5

a) The set of odd numbers ∪ the set of even numbers = ...

b) $\mathbb{Z} = \mathbb{Z}^+ \cup$ $\cup$

c) is the smallest positive number.

d) $\mathbb{Z}^- = \mathbb{Z} -$

e) $\mathbb{Z}^+ \cap \mathbb{Z}^-$ = ...

f) $-|-54| =$

g) $\mathbb{Z}^-$ $\mathbb{N}$

h) $\{15\}$ $\mathbb{Z}^-$

2 Arrange the following numbers descendingly: / 3

– 9 , 0 , 7 and –15

.....

.....

3 Represent the following operations on the number line: / 4

a) $19 - |-9|$

b) $4 - 6$

4 Use the properties of addition and subtraction in $\mathbb{Z}$ to find the result of the following: / 4

a) $(-5) + 8 - 15 =$

b) $(-1) + 4 + 41 =$

5 One night in winter, the TV announcer of the weather forecast announced that the temperature in Cairo is 18 °C and in Moscow is – 4 °C. Calculate the difference in temperature between Cairo and Moscow. What would you advise the travellers from Cairo to Moscow? / 3

.....

.....

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6 ***Find the result of the following:*** / 6

a) $(-36) \div (-4)$ b) $2^3 \times (-1)^2 \div 8$ c) $\frac{(-4)^{11} \times (4)^5}{(4)^{12}}$

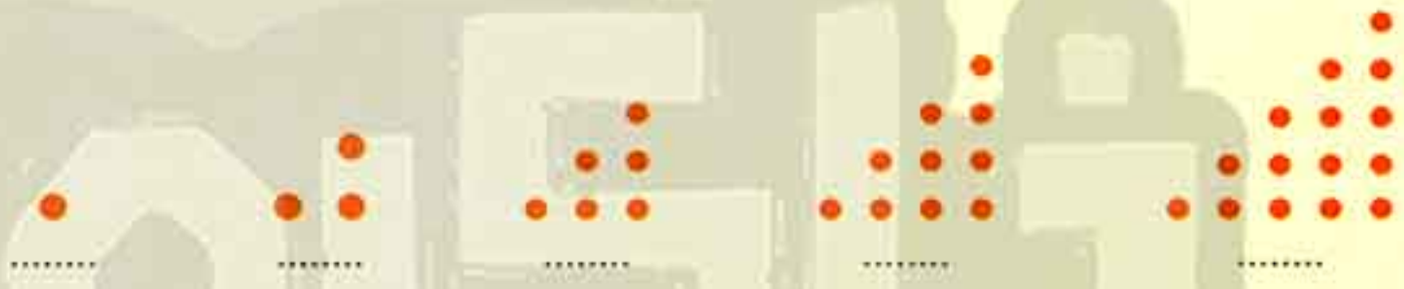
7 Khaled decided to lose weight at the rate of 3 kg monthly. / 5

If he weighs 90 kg right now, then how many months does he need to reach 69 kg? Write the rule expressing this numerical pattern and describe it.

.....

.....

8 ***Write the number of dots below each of the following, then complete:*** / 5



The number of dots:

The numerical pattern:

The rule of the pattern:



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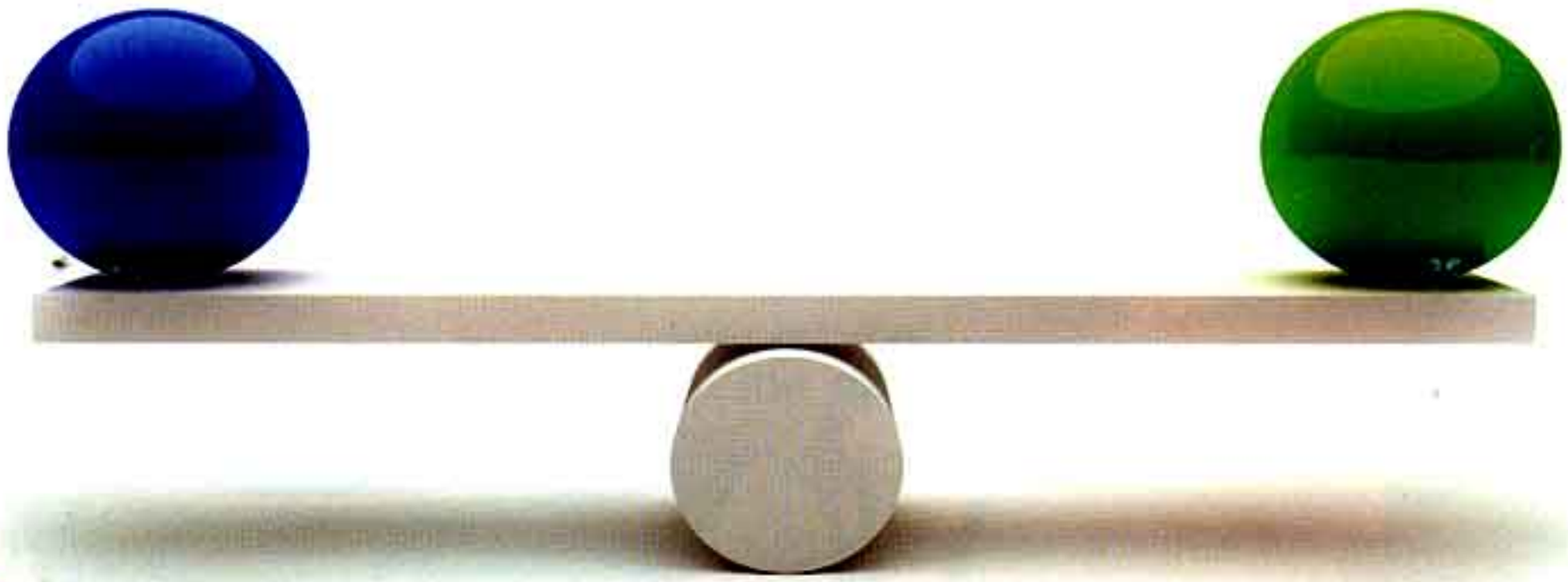


Unit 2

THE EQUATIONS AND THE INEQUALITIES

- Lesson 1 : The equations and the inequalities of the first degree
- Lesson 2 : Solving the first degree equation in one unknown
- Lesson 3 : Solving the first degree inequality in one unknown
- Selected problems from previous exams on Unit (2)
- Test on Unit (2) from the School Book

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Lesson 1

THE EQUATIONS AND THE INEQUALITIES OF THE FIRST DEGREE

Aims

At the end of this lesson, you will be able to:

(1) identify the concept of the equation and how we solve the first degree equation.

(2) identify the concept of the inequality and how we solve the first degree inequality.

(3) recognise the difference between the concept of equation and inequality.

watch video

WARM UP

- **In the opposite figure:**

 the right side is in balance with the left side;

 this situation expresses the equation where:

 Weight (Right side) = Weight (Left side)

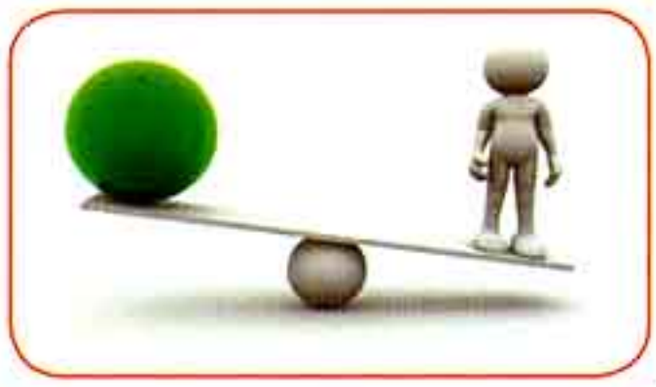


- **In the opposite figure:**

 the right side is heavier than the left side;

 this situation expresses the inequality where:

 Weight (Right side) > Weight (Left side)



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First The concept of equation:

You have studied before that:

The mathematical sentences have two types:

(a) Numerical sentences:

For example:

$2 + 7 = 9$, $13 - 5 = 8$

$2 \times 9 = 18$, $8 \div 4 = 2$, etc.

are called **closed sentences**

because we can determine whether they are right or wrong.



The balance is in an equality position.

(Equality of two pans)

(b) Symbolic sentences:

For example:

$\Delta + 3 = 5$, $11 - \square = 8$

$x + 3 = 12$, $7 \times y = 28$, etc.

are called **open sentences** because each one contains an unknown symbol such as $\square$, Δ , x or y, etc.

So, we cannot determine whether these sentences are right or wrong unless we know the numerical value of the unknown symbol.

i.e. $\Delta + 3 = 5$ is an open sentence and if we replace Δ by 2 then it becomes $2 + 3 = 5$ which is a closed sentence.

Note that:

The mathematical sentence (open or closed) which contains "=" is called an equation.

Definition:

The equation is a mathematical sentence that includes an equality relation between its two sides.

Each of the following is called an equation:

$x + 3 = 12$, $x - 7 = 9$, $2x = 8$, $\frac{x+2}{5} = 3$, $x^3 + 2 = 11$ and $x^2 + 3x^3 = 5$

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Note that:

1. The equation has two sides separated by the sign (=) between them where left hand side = right hand side.
 One or both of the two sides may contain one unknown or more.
2. The symbol x is called (the unknown or the variable).

Solved Example 1

Which of the following is an equation and which is not? (Giving a reason)

(a) $x + 7 = 9$
(b) $5 \times 3 = 15$
(c) $\frac{a}{7} = 5$
(d) $8 + x$
(e) $y \div 5$
(f) $x^2 + 5 = 14$

Solution

(a) It is an equation because it contains the sign "=".
(b) It is an equation because it contains the sign "=".
(c) It is an equation because it contains the sign "=".
(d) It isn't an equation because it doesn't contain the sign "=".
(e) It isn't an equation because it doesn't contain the sign "=".
(f) It is an equation because it contains the sign "=".

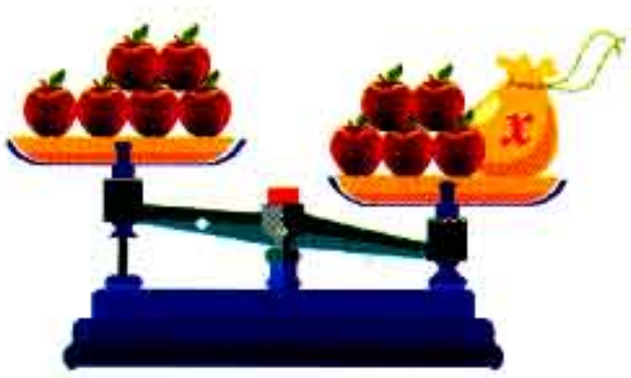
Check Point

Put (✓) if the sentence is an equation and (X) if it isn't:

(a) $3\,(9 + x) = 39$ ()
(b) $K - 17$ ()
(c) $3\,t = 36$ ()
(d) $x^3 + 3\,x^2 = 0$ ()
(e) $4\,x^2 \div 8$ ()

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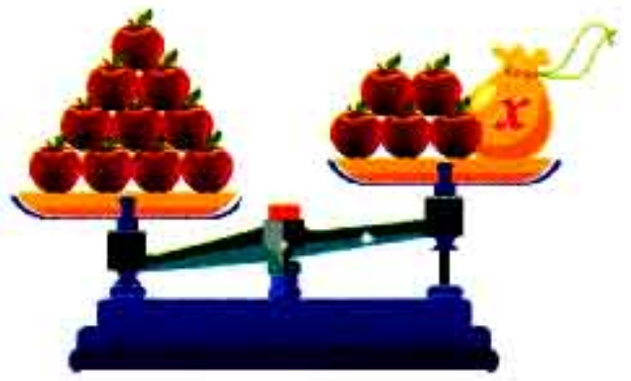
Second The concept of the inequality:



In figure (1):

The right pan is heavier than the left one, we express this position by the mathematical sentence $x + 5 > 6$.

(We read it as: $x + 5$ is greater than 6.)



In figure (2):

4 apples are added to the left pan, we express this case by the mathematical sentence $x + 5 < 10$.

(We read it as: $x + 5$ is less than 10.)

Each of the two mathematical sentences in the previous figures is called ***inequality***.

Definition:

The inequality is a mathematical sentence that includes the sign of inequality (<, >, ≤, ≥) between its two sides.

Each of the following is called an inequality.

$x > 4$, $x + 2 < 5$, $x - 3 > 6$, $x + 1 \geq 4$

Note that:

1. The sign **<** is read as less, than and the sign **>** is read as greater than.
2. The sign **≤** is read as less than **or** equal.

 Ex. In the inequality $x <$ –3, the unknown x takes numbers less than –3, while in $x \leq$ –3 the unknown x takes –3 and numbers less than –3
3. The sign **≥** is read as greater than **or** equal.

 Ex. In the inequality $x >$ 4, the unknown x takes numbers greater than 4, while in $x \geq 4$ the unknown x takes 4 and numbers greater than 4

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Third The degree of the equation and the inequality:

Definition

The degree of the equation (or inequality):

is the highest power of the unknown (or symbol) in this equation (or inequality).

For example:

- $2x + 1 = 9$ is an equation of the first degree (where the power of x is 1).
- $x^2 - 5 = 7$ is an equation of the second degree (where the power of x is 2).
- $7 + x < 16$ is an inequality of the first degree (where the power of x is 1).

Solved Example 2

Determine the degree of each of the following:

(a) $x + 1 = 5$

(b) $x^2 + 4 = 8$

(c) $y > 5$

(d) $x^2 + x^4 + x = 5$

(e) $\frac{z}{2} - 4 = 5$

(f) $y + 7 > 0$

Solution

(a) $x + 1 = 5$ is an equation of the first degree.

(b) $x^2 + 4 = 8$ is an equation of the second degree.

(c) $y > 5$ is an inequality of the first degree.

(d) $x^2 + x^4 + x = 5$ is an equation of the fourth degree.

(e) $\frac{z}{2} - 4 = 5$ is an equation of the first degree.

(f) $y + 7 > 0$ is an inequality of the first degree.

Check Point

Determine the degree of each of the following expressions:

(a) $x^5 + x^2 = 7$ **(b)** $\frac{x}{4} > 64$ **(c)** $4 - x^2 = 3$

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Fourth The solution of equation and inequality:

We will only study the solution of equations and inequalities of the 1st degree of one unknown.

1 *The solution of an equation:*

It is the number which satisfies the equation (***i.e.*** which makes the two sides of the equation equal).

For example:

In the equation $x + 3 = 8$, the solution is $x = 5$ because $5 + 3 = 8$
(***i.e.*** x = 5 satisfies this equation.)

Solved Example 3

For the equation $3x + 1 = 10$, check which element of the set {0, 1, 2, 3} is the solution.

Solution

The equation: $3x + 1 = 10$

The variable (x)	The left side	The right side	Solution or not a solution
When $x = 0$	$3 \times 0 + 0 = 0 + 1 = 1$	1	Not a solution
When $x = 1$	$3 \times 1 + 1 = 3 + 1 = 4$	4	Not a solution
When $x = 2$	$3 \times 2 + 1 = 6 + 1 = 7$	7	Not a solution
When $x = 3$	$3 \times 3 + 1 = 9 + 1 = 10$	**10**	Is the solution

REMARKS

- In the previous example, {0, 1, 2, 3} is called "the substitution set".
- { 3 } is called the solution set (or S.S.) of the equation $3x + 1 = 10$ (***i.e.*** S.S. = { 3 })
- The solution set should be a subset of the substitution set.

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Solved Example 4

If the substitution set is {1, 3, 6}, find the solution set of the equation

$x + 4 = 10$

Solution

By using each one of the elements of the substitution set {1 , 3 , 6}, we can determine which of them satisfies the equation:

Let $x = 1$ $\Rightarrow 1 + 4 = 5 \neq 10$ (1 is not the solution)

Let $x = 3$ $\Rightarrow 3 + 4 = 7 \neq 10$ (3 is not the solution)

Let $x = 6$ $\Rightarrow 6 + 4 = 10$ (6 is the solution)

So, the solution set = {6}

Then S.S. = {6}

Note that

$\{6\} \subset \{1, 3, 6\}$

Solved Example 5

Find the solution set of the equation: $2x + 4 = 14$

If the substitution set is { –2 , 2 , 3 , 6 }.

Solution

Let $x = -2 \Rightarrow 2 \times (-2) + 4 = -4 + 4 = 0 \neq 14$ (-2 is not the solution)

Let $x = 2 \Rightarrow 2 \times 2 + 4 = 8 \neq 14$ (2 is not the solution)

Let $x = 3 \Rightarrow 2 \times 3 + 4 = 10 \neq 14$ (3 is not the solution)

Let $x = 6 \Rightarrow 2 \times 6 + 4 = 16 \neq 14$ (6 is not the solution.)

So, the solution set = $\varnothing$ ***i.e.*** S.S. = { }

Check Point

Find the solution of the equation $2x + 3 = 7$, where the substitution set is {1, 2, 3}, then complete:

The S.S. of $2x + 3 = 7$ is

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2 The solution of an inequality:

If is the number (or numbers) which satisfy(ies) the inequality.

For example:

For the inequality $x + 1 \geq 5$, if the substitution set is {2, 4, 5, 6} then:

Let $x = 2$ $\Rightarrow$ $2 + 1 \not> 5$ (not a solution)

Let $x = 4$ $\Rightarrow$ $4 + 1 \geq 5$ (it is a solution)

Let $x = 5$ $\Rightarrow$ $5 + 1 \geq 5$ (it is a solution)

Let $x = 6$ $\Rightarrow$ $6 + 1 \geq 5$ (it is a solution)

So, S.S. = {4, 5, 6}

Solved Example 6

Find the solution set of the inequality $x + 2 > 6$ ***, if the substitution set = { 3, 4, 5, 7 }.***

Solution

Let $x = 3 \Rightarrow 3 + 2 = 5 \not> 6$ (3 is not a solution)

Let $x = 4 \Rightarrow 4 + 2 = 6 \not> 6$ (4 is not a solution)

Let $x = 5 \Rightarrow 5 + 2 = 7 > 6$ (5 is a solution)

Let $x = 7 \Rightarrow 7 + 2 = 9 > 6$ (7 is a solution)

So, S.S. = {5 , 7}

Check Point

Find the solution set of the inequality $x - 7 \leq |-4|$, if the substitution set = {7, 6 , 5 , 11, 4}.

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REMARKS

- The substitution set is a set of numbers which may contain the values of the solution of the equation or inequality.
- The solution set is a set of the values of the unknowns that satisfy the equation or the inequality.
- If x is greater than 5 and less than 8.

 i.e. ($x > 5$ and $x < 8$), then we express this in the form of an inequality as follows:

$$5 \underset{\text{(is greater than)}}{<} x \underset{\text{(is less than)}}{<} 8$$

(Start at x)

It is read as: x is greater than 5 and less than 8.

Solved Example 7

Find the solution set of the inequality $3 < x < 7$, if the substitution set is $\{4, 1, 3, 5, 8\}$.

Solution

Using the elements of the substitution set.

Let $x = 4 \Rightarrow 3 < 4 < 7$ (4 is a solution)

Let $x = 1 \Rightarrow 3 \not< 1 < 7$ (1 is not a solution)

Let $x = 3 \Rightarrow 3 \not< 3 < 7$ (3 is not a solution)

Let $x = 5 \Rightarrow 3 < 5 < 7$ (5 is a solution)

Let $x = 8 \Rightarrow 3 < 8 \not< 7$ (8 is not a solution)

Then S.S. = {4 , 5}

Check Point

Find the solution set of the inequality $-1 \leq x \leq 2$, if the substitution set is {–2 , –1 , 0 , 1 , 2 , 3}.

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EXERCISE 1

The equations and the inequalities of the first degree

1 ***Complete the following:***

a) $3x + 1 = 16$ is an equation of the degree.

b) The solution set of $2x - 1 = -1$ is, if the substitution set is {0 , 1 , 2 , 3}.

c) The equation is a mathematical sentence that includes relation between its two sides.

d) The equation $x^2 - 3 = 6$ is of the degree. *(Giza 2017)*

e) The solution set of the equation $2x - 1 = 15$, where $x \in \mathbb{Z}^-$ is *(Giza 2019)*

2 ***Choose the correct answer:***

a) If $2x = 6$, then $4x =$ (5 **or** 10 **or** 12) *(Cairo 2019)*

b) All the following numbers satisfy the inequality: $x > -3$ except

(0 **or** -1 **or** -2 **or** -4) *(Kafr El-Sheikh 2017)*

c) The greatest integer that satisfies the inequality: $x > -3$ is

(0 **or** -1 **or** -2 **or** -3) *(Kafr El-Sheikh 2016)*

d) $x^3 - 4 = 5$ is an equation of the degree.

(first **or** second **or** third **or** fourth) *(Giza 2016)*

e) $x^2 + 3 = 4$ is an equation of the degree.

(first **or** second **or** third **or** fourth) *(Alexandria 2019)*

f) If $x - 1 = 2$, then $x =$ where $x \in \mathbb{N}$. (-1 **or** -3 **or** 1 **or** 3) *(Cairo 2018)*

g) The greatest integer that satisfies $x < 6$ is (8 **or** 6 **or** 5 **or** 3)

h) Which of the following represents an equation?

($x - 17$ **or** $22 - 7$ **or** $x > -11$ **or** $2x + 3 = 7$)

3 ***Determine the degree of each of the following:***

a) 📖 $x - 7 = 1$ b) $x^2 + 3 = 8$ c) $2x^2 + 1 = 5$

d) 📖 $2x^2 - 2 = 14$ e) $3x^3 + 1 = 9$ f) $x^4 + x^2 + 1 =$ zero

g) $3y^2 + 1 = y^3$ h) 📖 $x - 2y = 5$ i) $x^2 + x < 1$

j) 📖 $x + 3 > 2$ k) $3a^2 + 1 < 10$ l) 📖 $x^3 - 4x^2 =$ zero

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4 ***Find the solution set of each of the following equations in ℤ:***

a) $x + 3 = 7$, if the substitution set is {2, 3, 4, 5, 6}

b) 📖 $x + 5 = 12$, if the substitution set is {3, 5, 7, 8}

c) $x - 3 = 5$, if the substitution set is {6, 7, 8, 9}

d) $x - 3 = -3$, if the substitution set is {–1, 0, 1, 2}

e) $4x = 20$, if the substitution set is {3, 4, 5, 6, 7}

f) $3x - 2 = 7$, if the substitution set is {–1, 0, 1, 2, 3}

g) 📖 $2x + 4 = 14$, if the substitution set is {–2, 2, 3, 5}

h) $3 + 2y = 13$, if the substitution set is {–5, –1, 0, 1, 5}

i) $-2 + 3b = 7$, if the substitution set is {5 , 1 , 2}.

j) 📖 $4x - 3 = 9$, if the substitution set is {2 , 3 , 4 , 6}

5 ***Find the solution set of each of the following inequalities in ℤ:***

a) 📖 $x + 3 < 5$, if the substitution set is {4 , 3 , 2 , 1 , 0}

b) $5 + x > 10$, if the substitution set is {7 , 6 , 5 , 4}

c) $x - 2 > -1$, if the substitution set is {0 , 1 , 2, 3}

d) $x - 1 < 2$, if the substitution set is {–1 , 0 , 1 , 2 , 3}

e) $4x - 3 \leq 5$, if the substitution set is {3 , 2 , 1 , 0 , -1}

f) 📖 $3x - 1 > -2$, if the substitution set is {–2 , –1 , 0 , 1 , 2}

g) 📖 $-x + 1 < 4$, if the substitution set is {–3 , –2 , 0 , 2 , 3}

h) $3x + 4 > 1$, if the substitution set is {–3 , –2 , –1 , 0 , 1}

i) $2x + 1 < -3$, if the substitution set is {–3 , –4 , –5 , – 6}

j) 📖 $2x + 5 > 2$, if the substitution set is {–3 , –2 , –1 , 0 , 1}

6 📖 ***Given that: the substitution set M = {–1 , –2 , 0 , 2}:***

a) Find the solution set of the equation $2x + 1 = 5$

b) Find the solution set of the inequality $x - 3 < -1$

7 ***If the substitution set is {3 , 6 , 9 , 12 , 15}, find the solution set of the following:***

a) $2x + 1 = 13$ b) $12 + 5x = 27$

c) $x + 2 = 24$ d) $2(x - 1) = 16$

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8 a) **Find the *solution set* of the following equation:**

$5x - 3 = |-12|$, where the substitution set is {2 , 3 , 4 , 5 , 6}.

b) **Find the solution set of the following inequality:**

zero $\leq x \leq |-2|$, where the substitution set is {– 3 , – 2 , – 1 , 0 , 1}.

c) **Find the solution set of the following equation:**

$2(x - 3) = x + 1$, where the substitution set is {4 , 5 , 6 , 7}.

d) Consider that the substitution set is M = {1, 2, 3}.

Find the solution set of the equation $3x - 1 = 11$

Cumulative Exercise

9 ***Express symbolically each of the following:***

a) x is greater than 2

b) x is less than or equal to – 4

c) x is greater than or equal to 3

d) x is less than or equal to 7 and greater than 1

e) x is greater than or equal to –6 and less than or equal to 2

10 ***Find the solution set of each of the following:***

a) $|x| + 15 = 17$, if the substitution set is {– 3 , – 2 , – 1 , 0, 2}.

b) $\frac{1}{2}|x| + 2 = 4$, if the substitution set is {0 , – 2 , – 4 , 4 , 6 , 8}.

c) $-1 \leq 3x + 2 \leq 8$, if the substitution set is {– 2 , – 1 , 0 , 1 , 2 , 3}.

d) $-3 \leq x < 2$, if the substitution set is {1 , 2 , 3 , – 1 , – 2}.

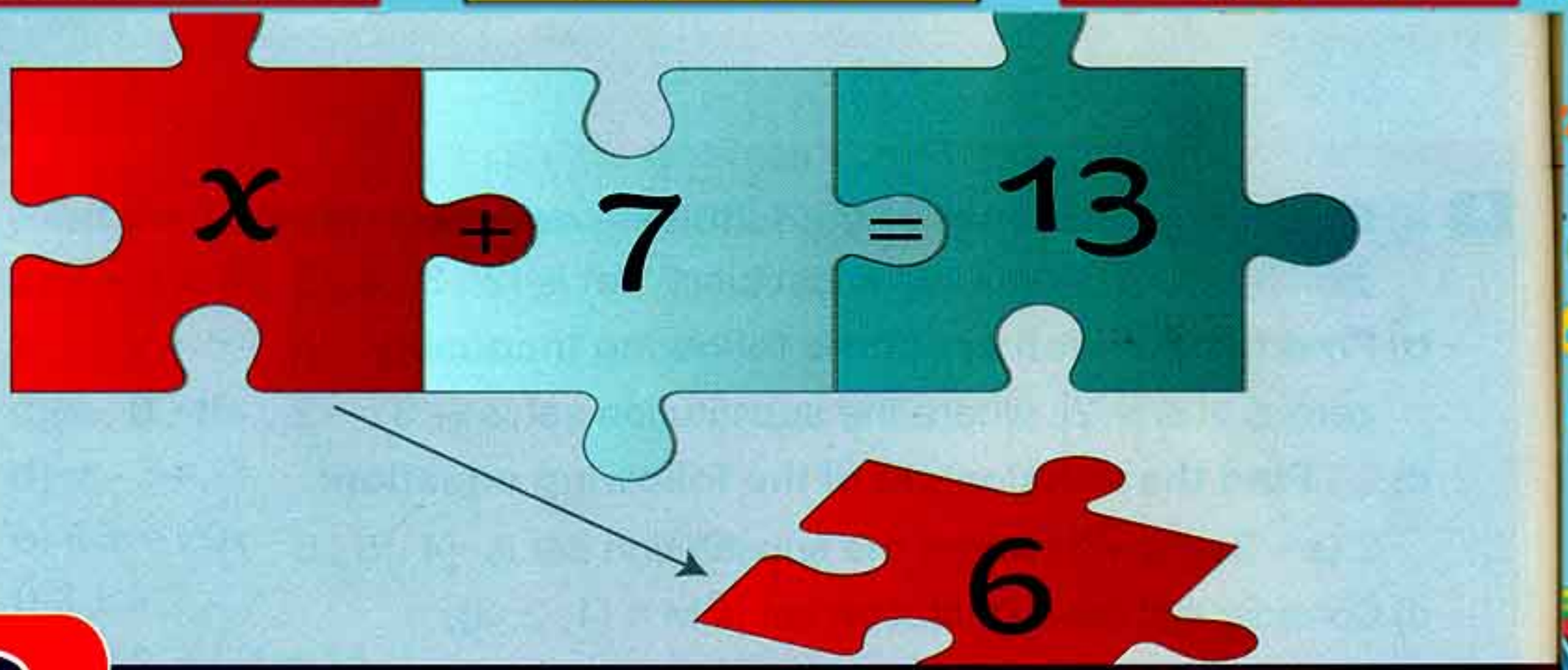
Think and Explore

11 a) If **+ 2 = 20 , find the value of** using the set of digits {5 , 6 , 8 , 3}.

b) If  +  = 18 , and  = 18,

then = ...

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Lesson 2

SOLVING THE FIRST DEGREE EQUATION IN ONE UNKNOWN

Aims

At the end of this lesson, you will be able to:

(1) recognise the properties of equality in $\mathbb{N}$, $\mathbb{Z}$.

(2) solve the first degree equation in one unknown (without using the substitution method).

watch video

WARM UP

Ahmed told his friend Samy that his age after four years would be 16 years old and asked him to guess how old he is now.

Samy said that the teacher of mathematics at the school did that by using an equation:

So, $x + 4 = 16$ where x is your age now.

and because $12 + 4 = 16$ therefore $x = 12$

then your age now = 12 years.



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Solving the first degree equation in one unknown (without using the substitution method)

Remember that:

The equation which has only "1" unknown and of the first degree power is called first degree equation in one unknown.

Prelude Examples:

Find the S.S. of the equation $2x + 1 = 19$

(Given that the substitution set is {1, 2, 3, 4, 5, ...})

Solution:

Using all the elements of the substitution set as:

Let $x = 1 \Rightarrow 2 \times 1 + 1 = 3 \neq 19$ (not a solution)

Let $x = 2 \Rightarrow 2 \times 2 + 1 = 5 \neq 19$ (not a solution)

Let $x = 3 \Rightarrow 2 \times 3 + 1 = 7 \neq 19$ (not a solution)

Let $x = 4 \Rightarrow 2 \times 4 + 1 = 9 \neq 19$ (not a solution)

Let $x = 5 \Rightarrow 2 \times 5 + 1 = 11 \neq 19$ (not a solution)

Let $x = 6 \Rightarrow 2 \times 6 + 1 = 13 \neq 19$ (not a solution)

Let $x = 7 \Rightarrow 2 \times 7 + 1 = 15 \neq 19$ (not a solution)

Let $x = 8 \Rightarrow 2 \times 8 + 1 = 17 \neq 19$ (not a solution)

Let $x = 9 \Rightarrow 2 \times 9 + 1 = 19$ (is a solution)

Then, S.S. = {9}

Note that:

- In some cases, the equation can be solved easily by using the substitution method.
- In other cases the substitution method is too long and difficult and may be impossible if the substitution set is an infinite set.
- So, in this lesson we will study easy and simple methods which depend on the properties of equality to solve the equations in $\mathbb{N}$ or $\mathbb{Z}$.

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First Adding and subtracting property:

If we add or subtract any integer to (or from) both sides of the equation, then the resultant sentence will be true.

For example:

a) If $4 + 2 = 6$, then $4 + 2 - 2 = 6 - 2 \Rightarrow 4 = 4$

b) If $x - 2 = 5$, then $x - \cancel{2} + \cancel{2} = 5 + 2 \Rightarrow x = 7$

c) If $x + 3 = 7$, then $x + \cancel{3} - \cancel{3} = 7 - 3 \Rightarrow x = 4$

By adding or subtracting the additive inverse.

In general

If a, b and c are three integers and If $a = b$, then $a + c = b + c$ and $a - c = b - c$

Solved Example 1

Solve the following equations:

(a) $x + 5 = 25$ in $\mathbb{N}$ (b) $2 = x + 3$ in $\mathbb{Z}$

Solution

(a) $\because x + 5 = 25$

$\therefore x + \cancel{5} - \cancel{5} = 25 - 5$ [Adding (–5) to both sides where (–5) is the additive inverse of 5]

$\therefore x = 20 \in \mathbb{N}$ $\therefore$ S.S. = { 20 }

(b) $\because 2 = x + 3$

$\therefore 2 - 3 = x + \cancel{3} - \cancel{3}$ [Adding (–3) to both sides of 5]

$\therefore -1 = x \in \mathbb{Z}$ $\therefore$ S.S. = { –1 }

Check Point

Find the solution set of each of following:

(a) $x - 4 = 7$ $x \in \mathbb{N}$ (b) $4 = x - 4$ $x \in \mathbb{Z}^+$

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Second Multiplication and division property:

If we multiply or divide the two sides of equation by a non-zero integer, then the resultant sentence will be true.

For example:

a) $\because \frac{8}{4} = 2$, $\therefore \cancel{4} \times \frac{8}{\cancel{4}} = 4 \times 2$ $\therefore 8 = 8$ (multiplying both sides by 4)

b) $\because \frac{x}{3} = 2$, $\therefore \frac{x}{\cancel{3}} \times \cancel{3} = 2 \times 3$ (multiplying both sides by 3)

$\therefore x = 6$

c) $\because 5x = 15$, $\therefore \frac{\cancel{5}x}{\cancel{5}} = \frac{15}{5}$ (dividing both sides by 5)

$\therefore x = 3$

In general

If a, b and c are three integers and if a = b, then $a \times c = b \times c$

and $a \div c = b \div c$, $c \neq 0$

Solved Example 2

Solve the following equations:

(a) $3x = 15$ in $\mathbb{N}$ (b) $\frac{x}{2} = -8$ in $\mathbb{Z}$

Solution

(a) $\because 3x = 15$ $\therefore \frac{\cancel{3}x}{\cancel{3}} = \frac{15}{3}$ (dividing both sides by 3)

$\therefore x = 5 \in \mathbb{N}$

(b) $\because \frac{x}{2} = -8$ (multiply each side by 2)

$\therefore \cancel{2} \times \frac{x}{\cancel{2}} = -8 \times 2$ $\therefore x = -16 \in$ in $\mathbb{Z}$

Check Point

(a) If $4x = 24$, then find x.

(b) If $\frac{x}{5} = -2$, then find x.

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Solved Example 3

Solve the equation $\frac{3}{5}x = -6$ ***in*** $\mathbb{Z}$

Solution

$\because \frac{3}{5}x = -6$

$\therefore \frac{3}{\cancel{5}}x \times \cancel{5} = -6 \times 5$ (multiplying both sides by 5)

$\therefore 3x = -30$

$\therefore \frac{3x}{3} = \frac{-30}{3}$ (dividing both sides by 3)

$\therefore x = -10 \in \mathbb{Z}$

Solved Example 4

Solve the equation $3x + 17 = 2$ ***in*** $\mathbb{N}$ ***and*** $\mathbb{Z}$

Solution

$\because 3x + 17 = 2$

$\therefore 3x + 17 + (-17) = 2 + (-17)$ (adding the additive inverse of 17 to both sides)

$\therefore 3x + 0 = -15$

$\therefore 3x = -15$ (0 is the identity additive element))

$\therefore \frac{3x}{3} = \frac{-15}{3}$ (dividing both sides by 3)

$\therefore x = -5 \notin \mathbb{N}$ $\therefore$ S.S. = $\varnothing$ in $\mathbb{N}$

$\therefore x = -5 \in \mathbb{Z}$ $\therefore$ S.S. = $\{-5\}$ in $\mathbb{Z}$

Check Point

Find the solution set of the equation:

$2x + 7 = 3$ in $\mathbb{N}$ and $\mathbb{Z}$

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Solved Example 5

Solve the equation: 2 (x – 2) + 5 = (–15) in ℕ and ℤ

Solution

$\because\ 2(x-2)+5=-15$

$\therefore\ 2(x-2)=-15-5$ (adding the additive inverse of 5)

$\therefore\ 2(x-2)=-20$

$\therefore\ \frac{2(x-2)}{2}=\frac{-20^{10}}{2}$ (dividing both sides by 2)

$\therefore\ x-2=-10$

$\therefore\ x-2+2=-10+2$ (adding the additive inverse of 2 to both sides)

$\therefore\ x=-8$ in ℕ : S.S. = ∅ in ℤ : S.S. = {– 8}

Another solution:

$\because\ 2(x-2)+5=-15$ $\therefore\ 2x-4+5=-15$ (distribution property)

$\therefore\ 2x+1=-15$ then complete.

Solved Example 6

If Mona and Ali try to find the solution set of the equation 4 – 2 x = 6 in ℕ, determine the one whose answer is right.

Solution

Mona's answer

$\therefore\ 4-2x=6$

$\therefore\ -2x=6-4$

$\therefore\ -2x=2$

$\therefore\ x=\frac{2}{-2}$

$\therefore\ x=-1$ $\therefore$ S.S. = {–1}

Comment:

Mona's mistake:

$x=-1$

(wrong step because: $-1\notin\mathbb{N}$)

Ali's answer

$\therefore\ 4-2x=6$

$\therefore\ -2x=6-4$

$\therefore\ \frac{-2x}{-2}=\frac{2}{-2}$

$\therefore\ x=-1$

$\because\ -1\notin\mathbb{N}$ $\therefore$ S.S. = ∅

Comment:

Ali's answer:

is the right answer.

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Solved Example 7

If a number is added to three times itself (or its triple), then the result will be 36, what is the number?

Solution

Let the number = x ∴ 3 times the number = $x + x + x$

∴ We form the equation: $x + x + x + x = 36$

∴ $4x = 36$

∴ $x = \frac{36}{4} = 9$

∴ The number is 9

Note that:

Check your answer as:

$9 + 9 + 9 + 9 = 36$

three times

Check Point

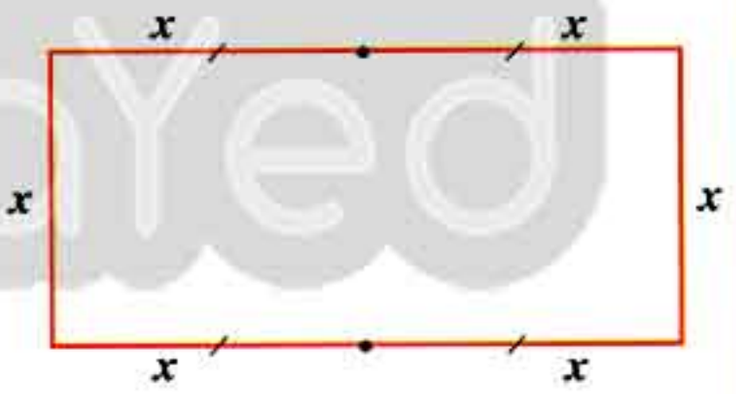
If we add a number to its double, the result is 12. ***What is the number?***

Solved Example 8

A rectangle whose length is twice its width and its perimeter is 36 cm. Find its area.

Solution

Let x be the width of the rectangle, then the length is $2x$.



∴ The perimeter = $2x + x + 2x + x = 36$

∴ $6x = 36$

∴ $\frac{6x}{6} = \frac{36}{6}$ (dividing both sides by 6)

∴ $x = 6$

So, the width = 6 cm and the length = 12 cm and the area = $12 \times 6 = 72\ cm^2$

Check Point

Three consecutive natural numbers whose sum is 78. ***What are these numbers?***

A tip: Let the three numbers be: x , $x + 1$, $x + 2$, then we can write the equations as: $x + x + 1 + x + 2 = 78$

..... Complete.

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EXERCISE 2

Solving the first degree equation in one unknown

1 ***Choose the correct answer:***

a) If $x - 4 = 6$, then x = ... (6 , 7 **or** 8 **or** – 8 **or** 10)

b) If $x + 2 = 5$, $x \in \mathbb{Z}^+$, then the solution set is ({3} **or** {– 5} **or** {–3} **or** ∅)

c) The solution set of the equation: $x - 1 = 3$ in $\mathbb{Z}$ is

({3} **or** {–1} **or** {4} **or** {–3})

d) The solution set of the equation: $2x - 1 = |-5|$ in $\mathbb{Z}$ is

({3} **or** {– 3} **or** {6} **or** {–6}) ***(Gharbia 2017)***

e) If $x + 6 = 2$, $x \in \mathbb{Z}$, then x = ... ({4} **or** – 4 **or** {5} **or** – 3) ***(Qena 2019)***

f) If $3x + 9 =$ zero , then the solution set is ({9} **or** {– 9} **or** {3} **or** {– 3})

g) If $x + 2 = |-4|$, then x = ... (– 2 **or** 2 **or** – 6 **or** 6)

h) If $\frac{x}{3} = 5$, then x = ... (3 **or** 5 **or** 15 **or** – 5)

2 ***Complete the following:***

a) If $2x = 2$, then $4x$ = ...

b) If $\frac{x}{5} = 4$, then x = ...

c) If $9x = 18$, then $x + 1$ = ...

d) The solution set of the equation $3x = 12$, where $x \in \mathbb{Z}^+$ is

e) If $x - 3 = 4$, $x \in \mathbb{Z}$, then x = ...

f) If $3x + 9 =$ zero, $x \in \mathbb{Z}$, then x = ... ***(Beheira 2016)***

g) If $(x + 1)$ is the additive inverse of (-2), then x = ...

h) If $3x + 6 = 12$, then $\frac{1}{2}x$ = ...

i) If $6x = 36$, then $\frac{x}{3}$ = ...

j) If $(x - 3)$ is the additive inverse of (2), then x = ...

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3 ***Find the solution set of each of the following equations in*** $\mathbb{N}$***:***

a) $x + 3 = 9$ b) $x - 2 = 7$

c) $x + 8 = 19$ d) $2x - 1 = 9$

e) $5x + 1 = 16$ f) $4x + 1 = 17$

g) $6x + 7 = 25$ h) $7x + 1 = 22$

4 ***Find the solution set of each of the following equations in*** $\mathbb{Z}$***:***

a) $9x = -18$ b) $x - 12 = 40$

c) $x - 22 = 18$ d) $3x + 2 = 17$

e) $2x - 5 = -21$ f) $3x - 2 = -19$

g) $3x + 2 = x + 18$ h) $\frac{x-3}{4} = -2$

i) $2(x + 1) + 3 = x + 6$ j) $5(x + 1) = 3x - 3$

5 ***Study the possibility of solving each of the following equations in*** $\mathbb{N}$, $\mathbb{Z}$***:***

a) $3x = 8$ b) $3m + 12 = 6$ c) $2L - 15 = 8$

d) $\frac{x}{4} = -2$ e) $2x - 12 = |-14|$ f) $2L + 16 = 8$

6 ***Find the solution set of each of the following equations:***

a) $2x + 3 = 15$, where $x \in \mathbb{Z}$

b) $3x - 2 = 7$, where $x \in \mathbb{Z}$

c) $3x + 7 = 4$ in $\mathbb{Z}$

d) $2x - 5 = -21$ in $\mathbb{Z}$

e) $2x + 5 = -27$ in $\mathbb{N}$, $\mathbb{Z}$

f) $4 - 2x = 24$, where $x \in \mathbb{Z}$

g) $2(2x + 3) = 30$ in $\mathbb{Z}$

7 ***Answer each of the following:***

a) If $4x + 1 = 2x - 7$, find the value of x , where $x \in \mathbb{Z}$

b) If $4x - 7 = 2 + x$, find the value of x , where $x \in \mathbb{N}$

c) If $5x - 4 = 2x + 11$, find the value of x , where $x \in \mathbb{N}$

d) If $2(x - 3) = 3(x + 5)$, find the value of x , where $x \in \mathbb{Z}$

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8 If a number is added to its twice, the result will be 18, what is this number?

.....

9 If a number is added to its three times, the result will be 72, what is the number?

.....

10 Two consecutive numbers, their sum is 21. Find them.

.....

11 Three consecutive natural numbers, their sum is 105. Find them.

.....

Cumulative Exercise

12 ***In the opposite figure:***

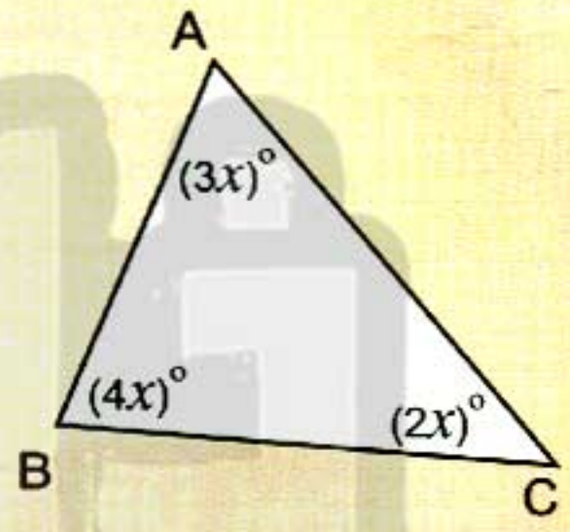
ABC is a triangle, where

$m(\angle A) = (3x)°$,

$m(\angle B) = (4x)°$,

$m(\angle C) = (2x)°$

Find the value of x.



13 A rectangle whose length is triple its width and its perimeter is 48 cm.

Find its area.

Think and Explore

14 **Think, then complete:**

a) If ○ + ○ + △ = 20 , and ○ + △ = 15,

then ○ = ... , ○ + ○ + ○ = ... , ○ + △ + △ = ...

b) If $|x - 1| = 2$, **then find the value of x.** *(Dakahlia 2014)*

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Lesson 3

SOLVING THE FIRST DEGREE INEQUALITY IN ONE UNKNOWN

Aims

At the end of this lesson, you will be able to:

(1) recognise the properties of inequality in $\mathbb{N}$, $\mathbb{Z}$.

(2) solve the first degree inequality in one unknown (without using the substitution method).

watch video

WARM UP

- In the previous lesson, you have learned how to solve the first degree equation in one unknown by using **the properties of equality** in $\mathbb{N}$, $\mathbb{Z}$ as:

 $2x - 1 = 5 \Rightarrow 2x = 5 + 1 \Rightarrow 2x = 6 \quad \therefore x = 3$



- In this lesson you will learn how to solve the first degree inequality in one unknown by using **the properties of inequality** in $\mathbb{N}$, $\mathbb{Z}$ as:

 $x - 1 < 3$



A good student said:

I can do that easily as: $x - 1 + 1 < 3 + 1$ **so,** $x < 4$

In $\mathbb{N}$ S.S. = {3, 2, 1, 0} in $\mathbb{Z}$ S.S. = {3, 2, 1, 0, –1, –2, ... }



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Properties of inequality in ℕ and ℤ:

a) When adding or subtracting the same integer (to or from) both sides of the inequality, the resultant sentence will be true:

i.e. ∵ $6 > 3$, ∴ $6 + 1 > 3 + 1$ because $7 > 4$

also $6 - 1 > 3 - 1$ because $5 > 2$

For example:

1) ∵ $x + 5 < 9$, ∴ $x + \cancel{5} - \cancel{5} < 9 - 5$

∴ $x < 4$

Add the additive inverse of 5 to both sides to cancel 5 from the left side.

2) ∵ $x - 3 \geq 7$, ∴ $x - \cancel{3} + \cancel{3} \geq 7 + 3$

∴ $x \geq 10$

Add the additive inverse of – 3 to both sides to cancel – 3 from the left side.

In general

If a, b and c are three integers and a > b, then:

- $a + c > b + c$ and $a - c > b - c$

or - $a < b$ then $a + b < b + c$ and $a - c < b - c$

b) When multiplying or dividing both sides of an inequality by the same positive integer, the resultant sentence will be true:

i.e. ∵ $6 > 4$, ∴ $6 \overset{(12)}{\times} 2 > 4 \overset{(8)}{\times} 2$

also $6 \overset{(3)}{\div} 2 > 4 \overset{(2)}{\div} 2$

c) When multiplying or dividing both sides of an inequality by the same negative integer, the resultant sentence will be true after changing the direction of the inequality:

i.e. ∵ $6 > 4$, ∴ $6 \overset{(-12)}{\times} (-2) < 4 \overset{(-8)}{\times} -2$ (The direction is changed.)

also $6 \overset{(-3)}{\div} (-2) < 4 \overset{(-2)}{\div} (-2)$ (The direction is changed.)

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For example:

a) $\because 3x > 9$ Same direction $\therefore \frac{3x}{3} > \frac{9}{3}$ $\therefore x > 3$

b) $\because -3x > 9$ Change direction $\therefore \frac{-3x}{-3} < \frac{9}{-3}$ $\therefore x < -3$

c) $\because \frac{1}{2}x < 10$ Same direction $\therefore 2 \times \frac{1}{2}x < 10 \times 2$ $\therefore x < 20$

d) $\because -\frac{1}{2}x < 10$ Change direction $\therefore -2 \times -\frac{1}{2}x > -2 \times 10$ $\therefore x > -20$

In general

If a, b and c are three integers and a > b, then:

1. $a \times c > b \times c$ (If c is a positive number.)
 $a \times c < b \times c$ (If c is a negative number.)
2. $\frac{a}{c} > \frac{b}{c}$ (If c is a positive number.)
 $\frac{a}{c} < \frac{b}{c}$ (If c is a negative number.)

Solved Example 1

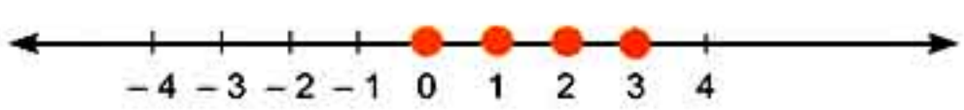
Find the solution set of the inequality $x + 5 \leq 8$ in $\mathbb{N}$, $\mathbb{Z}$ and represent it on the number line.

Solution

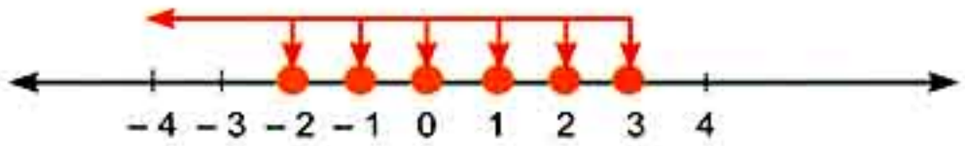
$\because x + 5 \leq 8$

$\therefore x + 5 - 5 \leq 8 - 5$ (adding the additive inverse of 5 to both sides)

$\therefore x \leq 3$ If $x \in \mathbb{N}$ $\therefore$ The S.S. = {0, 1, 2, 3}



and if $x \in \mathbb{Z}$ $\therefore$ The S.S. = {3, 2, 1, 0, −1, −2, ⋯}



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Solved Example 2

Find the solution set of the inequality $-2x < 8$ in $\mathbb{N}$, $\mathbb{Z}$, then represent it on the number line.

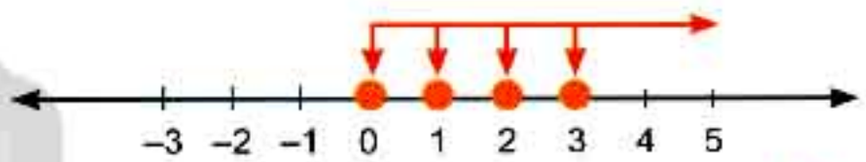
Solution

$\because \quad -2x < 8$ (dividing both sides by -2)

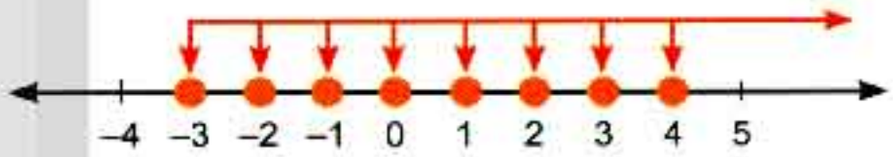
$\therefore \quad \frac{-2x}{-2} > \frac{8}{-2}$ (changing the direction of the inequality)

$\therefore \quad x > -4$

If $x \in \mathbb{N}$ $\therefore$ The S.S. = {0, 1, 2, 3, ...}



If $x \in \mathbb{Z}$ $\therefore$ The S.S. = {–3, –2, –1, 0, 1, 2, ...}



Solved Example 3

Find the solution set of the inequality $2x + 7 < 3$, then represent it on the number line if: (a) $x \in \mathbb{N}$ (b) $x \in \mathbb{Z}$

Solution

$\because \quad 2x + 7 < 3$

$\therefore \quad 2x + 7 - 7 < 3 - 7$ (adding the additive inverse of 7 to both sides)

$\therefore \quad 2x < -4$

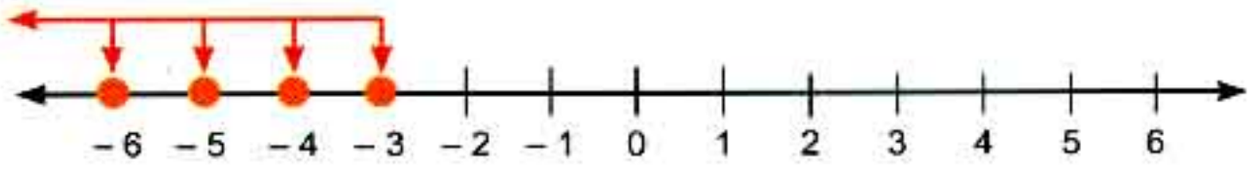
$\therefore \quad \frac{2x}{2} < \frac{-4}{2}$ (dividing both sides by 2)

$\therefore \quad x < -2$ (without changing the direction of the inequality)

(a) If $x \in \mathbb{N}$ $\therefore$ The S.S. = $\varnothing$

(b) If $x \in \mathbb{Z}$

$\therefore$ The S.S. = {–3, –4, –5, ... }



Check Point

Find the solution set of each of the following inequalities:

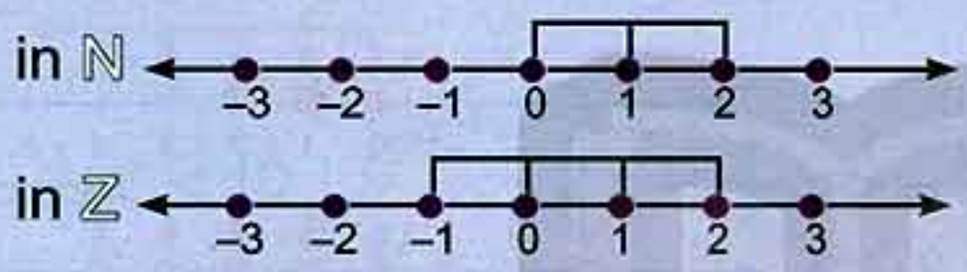
(a) $2x - 5 \geq 5$, ***where*** $x \in \mathbb{Z}$ **(b)** $1 - 3x > 10$, ***where*** $x \in \mathbb{Z}$

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IMPORTANT REMARKS

❶ In the inequality $-2 < x < 3$

- It means that $x > -2$ and $x < 3$
- -2 is the left side, x is the middle side and 3 is the right side.
- It is read as x is greater than -2 and less than 3
- In $\mathbb{N}$ S.S. = {0 , 1 , 2} and in $\mathbb{Z}$ S.S. = {–1 , 0 , 1 , 2}
- It can be represented on the number line as:



❷ In the inequality $-7 < x \leq -3$

- It means that $x < -7$ and $x \leq -3$
- -7 is the left side, x is the middle side and -3 is the right side.
- It is read as x is greater than -7 and less than or equal to -3
- In $\mathbb{N}$ S.S. = $\varnothing$ and in $\mathbb{Z}$ = {– 6 , – 5 , – 4 , – 3}
- It can be represented on the number line in $\mathbb{Z}$.



❸ In the inequality $-2 < x + 1 \leq 5$ to get its solution we do as follows:

$\because -2 < x + 1 \leq 5$

$\therefore -2 - 1 < x + 1 - 1 \leq 5 - 1$ (add –1 to the 3 sides)

$\therefore -3 < x \leq 4$

$\therefore$ S.S. in $\mathbb{N}$ = {0 , 1 , 2 , 3 , 4} , S.S. in $\mathbb{Z}$ = {– 2 , –1 , 0 , 1 , 2 , 3 , 4}

❹ In the inequality $-6 \leq -2x \leq 2$ to get its solution we do as follows:

$\because -6 \leq -2x \leq 2$

$\therefore \frac{-6}{-2} \geq \frac{-2x}{-2} \geq \frac{2}{-2}$ (change direction)

$\therefore 3 \geq x \geq -1$

$\therefore$ The S.S. in $\mathbb{N}$ = {0 , 1 , 2 , 3} , The S.S. in $\mathbb{Z}$ = {–1 , 0 , 1 , 2 , 3}

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Solved Example 4

Find the solution set of the inequality $-4 \leq 3x + 2 < 17$, then represent it on the number line if: (a) $x \in \mathbb{N}$ (b) $x \in \mathbb{Z}$

Solution

$\because -4 \leq 3x + 2 < 17$

$\therefore -4 - 2 \leq 3x + 2 - 2 < 17 - 2$

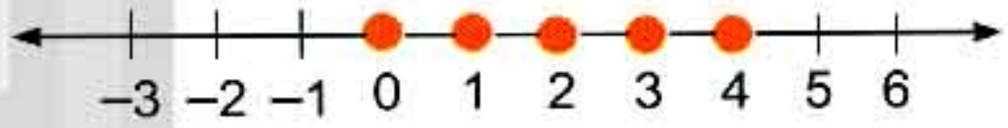
(adding the additive inverse of 2 to the three sides of the inequality)

$\therefore -6 \leq 3x < 15$

$\therefore \frac{-6}{3} \leq \frac{3x}{3} < \frac{15}{3}$ (dividing all sides by 3)

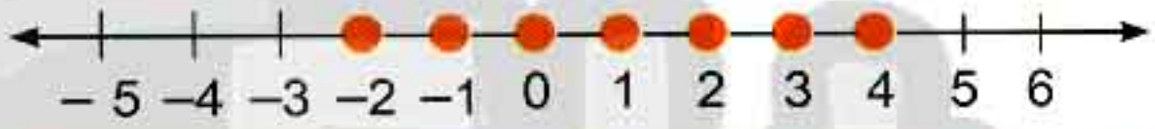
$\therefore -2 \leq x < 5$

(a) If $x \in \mathbb{N}$ $\therefore$ The S.S. = {0, 1, 2, 3, 4}



(b) If $x \in \mathbb{Z}$

$\therefore$ The S.S. = {– 2, – 1, 0, 1, 2, 3, 4}



Remember that

$\because$ means since

$\therefore$ means then or therefore

Solved Example 5

Find the solution set of the inequality $3 \leq 1 - 2x \leq 7$

(a) in $\mathbb{N}$ (b) in $\mathbb{Z}$

Solution

$\because 3 \leq 1 - 2x \leq 7$

$\therefore -1 + 3 \leq -1 + 1 - 2x \leq -1 \neq 6$ (add –1 to the 3 sides)

$\therefore 2 \leq -2x \leq 6$

$\therefore -1 \geq x \geq -3$ (divide the 3 sides by – 2)

$\therefore$ The S.S. in $\mathbb{N}$ = { } , The S.S. in $\mathbb{Z}$ = {– 3 , – 2 , –1}

Check Point

Find the S.S. of the following inequalities:

(a) $-9 \leq 2x - 3 < 3$, ***where*** $x \in \mathbb{Z}$ **(b)** $3 < -x + 2 \leq 6$, ***where*** $x \in \mathbb{N}$

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Solved Example 6

Find the solution set of the inequality: $4x + 3 \leq 6x + 11$, where $x \in \mathbb{Z}$, then represent it on the number line:

Solution

$\because 4x + 3 \leq 6x + 11$

(adding the additive inverse of $6x$ to both sides to cancel it from the right side)

$\therefore$ then: $4x - 6x + 3 \leq 6x - 6x + 11$

$\therefore -2x + 3 \leq 11$

$\therefore -2x + 3 - 3 \leq 11 - 3$ (adding the additive inverse of 3)

$\therefore -2x \leq 8$

$\therefore \frac{-2x}{-2} \geq \frac{8}{-2}$ (dividing by -2)

$\therefore x \geq -4$ and $x \in \mathbb{Z}$

$\therefore$ The S.S. $= \{-4, -3, -2, -1, 0, 1, 2, \ldots\ldots\}$



Remember that

When we divide or multiply by a negative number, we change the direction of the sign from ≤ to ≥. (Reverse the sign.)

Another solution:

$\because 4x + 3 \leq 6x + 11$

$\therefore -4x + 4x + 3 \leq -4x + 6x + 11$

(adding the additive inverse of $4x$ to cancel it from the left side)

$\therefore 3 \leq 2x + 11$

$\therefore -8 \leq 2x$

$\therefore -4 \leq x$, then we continue

$\therefore -11 + 3 \leq 2x + 11 + (-11)$

$\therefore \frac{-8}{2} \leq \frac{2x}{2}$

Check Point

Find the solution set of the following inequality, then represent the solution set on the number line:

$-2 + 17x > -16 + 10x$, ***where*** $x \in \mathbb{N}$

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EXERCISE 3

Solving the first degree inequality in one unknown

1 *First: Express symbolically each of the following:*

a) x is less than –5

b) x is greater than or equal to 3

c) x is less than or equal to 2

d) x is less than 5 and greater than 2

e) x is less than or equal to 7 and greater than 1

f) x is less than or equal to 1 and greater than or equal to –4

Second: If $x \in \mathbb{Z}$, then complete:

a) If $x + 5 > 2$, then $x >$

b) If $2x + 1 \geq 5$, then $2x \geq$ then $x \geq$

c) If $-3x - 1 \leq 8$, then $-3x \leq$ then $x \geq$

2 ***Find the solution set of each of the following in $\mathbb{N}$, then represent it on the number line:***

a) $x + 4 > 5$

b) $x - 3 < 1$

c) $x + 7 > 4$

d) $x + 4 < 7$

e) $5x \geq 30$

f) $-2x \geq 6$

3 ***Find the solution set of each of the following inequalities in $\mathbb{N}$ and $\mathbb{Z}$, then represent it on the number line:***

a) $x - 3 > 1$

b) $2x + 3 \geq 1$ *(Cairo 2019)*

c) $2x - 3 < 5$

d) $4x + 1 < 13$

e) $2x + 7 < 1$

f) $2x + 9 > 1$

g) $2x + 9 < 1$

h) $3x - 2 \leq 7$ *(Beheira 2016)*

4 ***Find the solution set of each of the following and represent it on the number line:***

a) $2x - 3 < 1$, where $x \in \mathbb{N}$ *(Cairo 2015)*

b) $3x + 2 \leq 11$, where $x \in \mathbb{N}$

c) $3x + 2 \geq 14$, where $x \in \mathbb{N}$

d) $3x - 7 \leq 5$, where $x \in \mathbb{Z}$

e) $2x - 5 \leq -7$, where $x \in \mathbb{Z}$

f) $1 - 8x < 33$, where $x \in \mathbb{Z}$

g) $2(x - 2) \leq 8$, where $x \in \mathbb{Z}$

h) $2(x + 3) \geq 5x$, where $x \in \mathbb{Z}$

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5 ***Find the solution set of the inequality: $5x - 4 \leq 6$, in each of the following cases:***

a) $x \in \mathbb{N}$ b) $x \in \mathbb{Z}$ c) $x \in \mathbb{Z}^+$

6 ***Choose the correct answer:***

a) The number which satisfies the inequality: $y - 3 > 4$ is

(2 **or** 4 **or** 6 **or** 8)

b) The number which satisfies the inequality: $x + 3 > -1$ is

.

(– 3 **or** – 4 **or** –5 **or** –6)

c) The solution set of the inequality: $-3x < 0$ in $\mathbb{Z}$ is

($\varnothing$ **or** $\mathbb{N}$ **or** $\mathbb{Z}^+$ **or** $\mathbb{Z}^-$)

d) The solution set of inequality: $2x + 5 > 3$ is

($\mathbb{N}$ **or** $\mathbb{N} - \{0\}$ **or** $\mathbb{Z}^+$ **or** $\mathbb{Z}^-$)

e) If $x > y$, then $2x$ $2y$. ($<$ **or** $>$ **or** $=$ **or** $\leq$)

f) If $x > y$, then $-x$ $-y$ where x and y are positive numbers.

($>$ **or** $<$ **or** $=$ **or** $\geq$)

g) If $a < b$, then $-3a$ $-3b$. ($>$ **or** $<$ **or** $=$ **or** $\geq$)

h) All the following numbers satisfy the inequality: $x > -3$ except

(0 **or** –1 **or** –2 **or** – 4)

i) The number which satisfies the inequality: $x > -1$ is

(0 **or** –1 **or** –2 **or** –3)

j) The solution set of the inequality: $3 < x < 4$, where $x \in \mathbb{Z}$ is

({3} **or** {4} **or** {3, 4} **or** $\varnothing$)

k) In the inequality: $-2 < a \leq 1$, if $a \in \mathbb{Z}$ then $a \in$

({–2, 1, 0} **or** {–2, –1, 0} **or** {–1, 0, 1} **or** {1, 0, 2})

l) The greatest number which satisfies the inequality $1 < x \leq 5$ is

(1 **or** 5 **or** 3 **or** 4)

m) The number $3 \in$ the solution set of the inequality

($x > 3$ **or** $x < 3$ **or** $-x < -4$ **or** $-x < 4$)

n) The solution set of the inequality $x - 1 \leq 1$ in $\mathbb{Z}^+$ is

({2, 0 ,–1, ... } **or** {0, –1 , –2 , ... } **or** {0} **or** {1,2})

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7 ***Complete the following:***

a) The solution set of the inequality: $x \leq 3$, $x \in \mathbb{N}$ is

b) The solution set of the inequality: $x + 5 > 2$ in $\mathbb{Z}$ is

c) The solution set of the inequality: $x - 3 > -4$ in $\mathbb{Z}^+$ is

d) The solution set of the inequality: $-3 < 3x < 3$ in $\mathbb{Z}$ is

e) The solution set of the inequality: $1 - x > 5$ in $\mathbb{N}$ is

f) The solution set of the inequality: $2 < x < 3$, in $\mathbb{Z}$ is

g) The solution set of the inequality: $2x > 5$, $x \in \mathbb{Z}$ is

h) The solution set of the inequality: $x >$ zero, where $x \in \mathbb{N}$ is

Cumulative Exercise

8 ***Find the solution set of each of the following inequalities in $\mathbb{N}$ and $\mathbb{Z}$, then represent it on the number line:***

a) $3 - 2x < 7$

b) $3x - 2 \geq 4$

c) $3x + 4 < 10$

d) $-x \geq 5$

e) $0 \leq x < 2$

f) $3x - 7 \leq -10$

9 ***Complete the following:***

a) If $x \geq 3$, then $x + 5 \geq$

b) If $A > B$, $C > 0$, then AC BC.

c) If $x < y$, $z <$ zero, then xz yz.

d) If $B < 0$, then $B + 2$ 2

e) If $A > B$, then $A + C$ $B + C$

Think and Explore

10 ***Find the solution set of the following inequality:***

$3x - 2 \leq x + 12$, where $x \in \mathbb{Z}$.

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Selected problems from previous exams on Unit 2

1 Complete the following:

1) If $x + 2 = |-5|$, then $x =$ (Fayoum 2017)

2) If $3x < 6$, $x \in \mathbb{N}$, then the solution set is (Giza 2019)

3) The equation $x^2 - 5 = 11$ is of the degree. (Sohag 2017)

4) If $3x + 9 =$ zero, $x \in \mathbb{Z}$, then $x =$ (Beheira 2016)

5) $|x| = 5$, then $x =$ (Cairo 2019)

6) If $2x = 10$, then $x =$ (Sharkia 2017)

2 Choose the correct answer:

1) The number which satisfies the inequality $x < -1$ in $\mathbb{Z}$ is

(zero **or** 1 **or** 2 **or** -2) (Ismailia 2017)

2) Salma paid x pounds to buy three pens, then the price of each one is

($\frac{3}{x}$ **or** $\frac{x}{3}$ **or** 3 **or** $3 + x$) (Dakahlia 2016)

3) The solution set of the inequality $x > 0$

($\mathbb{Z}$ **or** $\mathbb{Z}^+$ **or** $\mathbb{Z}^-$ **or** $\mathbb{N}$) (Cairo 2019)

4) If $1 - x > -2$, then ($x > -3$ **or** $x < 3$ **or** $x > -1$ **or** $x \geq 2$) (Giza 2019)

5) The S.S. of the equation $2x = -8$, $x \in \mathbb{N}$ is (Damietta 2016)

($\{-4\}$ **or** $\{4\}$ **or** $\{2\}$ **or** $\varnothing$) (Aswan 2013)

3 1) Find the solution set of the inequality $3x - 5 < 7$, where $x \in \mathbb{N}$, then represent it on the number line. (Cairo 2019)

2) Find the solution set of the equation $2x + 12 = 8$, where $x \in \mathbb{Z}$ (Dakahlia 2016)

3) Find the solution set in $\mathbb{Z}$ of the equation $2x + 5 = 9$ (Suez 2017)

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Unit Test (From the School Book)

2 on Unit

Total mark / 20

1 ***Complete the following:*** / 4

a) The equation is a mathematical sentence that

b) The inequality is a mathematical sentence that

c) The substitution set is

d) The solution set is

2 ***Choose the answer which satisfies each of the following equations and inequalities:*** / 4

a) $3x + 1 = -5$ (0 **or** -1 **or** 1 **or** -2)

b) $x - 1 = -2$ (3 **or** 0 **or** -1 **or** 1)

c) $x - 2 > 3$ (3 **or** 4 **or** 5 **or** 6)

d) $2x + 1 \leq -1$ (4 **or** 2 **or** 0 **or** -1)

3 ***Solve the following inequalities and represent the solution on the number line:*** / 6

a) $3x + 2 \geq 11$, where $x \in \mathbb{N}$

b) $4x + 1 < 13$, where $x \in \mathbb{Z}$

4 ***Solve the following equations in $\mathbb{Z}$:*** / 6

a) $6x - 2 = 14$

b) $2x + 1 = -9$

c) $7x + 5 = 26$

d) $4 - 2x = 24$

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Unit 3

GEOMETRY AND MEASUREMENT

- Lesson 1 : Distance between two points on the coordinate plane
- Lesson 2 : Geometric transformation (Translation)
- Lesson 3 : The area of the circle
- Lesson 4 : Lateral surface area and total surface area of a cube and a cuboid
- Selected problems from previous exams on Unit (3)
- Test on Unit (3) from the School Book

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Lesson 1

DISTANCE BETWEEN TWO POINTS ON THE COORDINATE PLANE

Aims

At the end of this lesson, you will be able to:

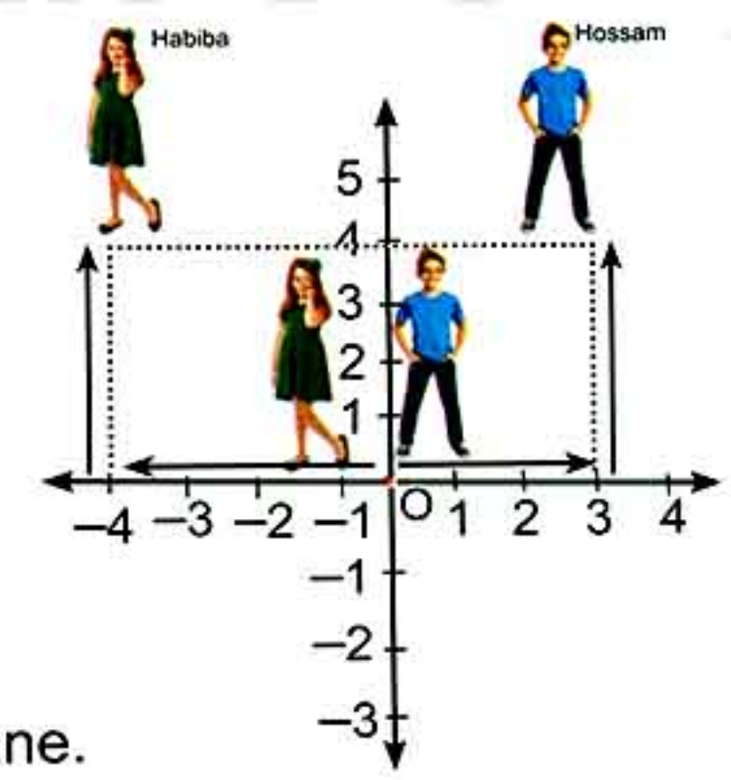
(1) calculate the distance between two points on a ray and a straight line.

(2) determine points in the coordinate plane (ℤ).

WARM UP

watch video

In the playground, the teacher made two perpendicular straight lines intersecting at the red point "O" which represents 0 starting from "o", Hossam was asked to move 3 steps to the right and then 4 steps upwards while Habiba was asked to move 4 steps to the left and 4 steps upwards. The distance between Habiba and Hossam is 7 units.



- The playground is exactly like the coordinate plane.

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First The distance between two points on a ray:

Observe the following:

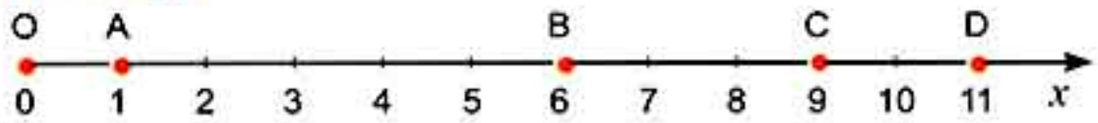


Figure (1)

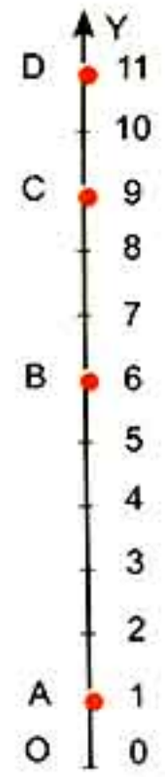


Figure (2)

1) In figure (1) the horizontal ray $\overrightarrow{ox}$ and in figure (2) the vertical ray $\overrightarrow{oy}$ are divided into equal distances starting with (O) which represents 0.

2) In each ray the points A, B, C and D represent 1, 6, 9 and 11 respectively, the distance between the two points A and B equals the length of $\overline{AB}$ or the length of $\overline{BA}$
where AB = |B – A| = |6 –1| = |5| = 5 length units.
and BA = |A – B| = |1– 6| = |– 5| = 5 length units

Note that

- The length of $\overline{BA}$ = |A – B| , the length of $\overline{AB}$ = |B – A| then the length of $\overline{AB}$ = the length of $\overline{BA}$.
- The distance between the two points A and C = the length of $\overline{AC}$ = |C – A| = |9 – 1| = |8| = 8 length units.
- The distance between D and A = the length of $\overline{DA}$ = |A – D| = |1 – 11| = |–10| = 10 length units.
- The distance between B and C = the length of $\overline{BC}$ = |C – B| = |9 – 6| = |3| = 3 length units.

So:

The distance between two points = the length of the line segment between those two points.
= |number of the ending point – number of the starting point|

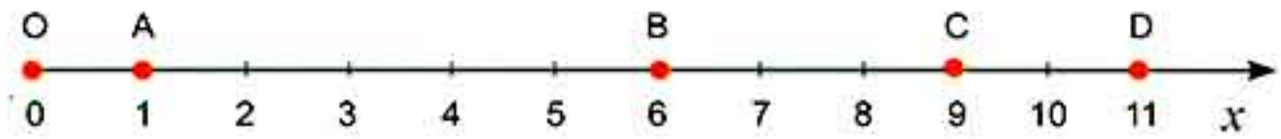
distance	مسافة	respectively	على الترتيب	represent	يمثل

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Solved Example 1

From the following figure, find:



(a) The length of $\overline{AD}$

(b) The length of $\overline{BD}$

(c) The length of $\overline{CA}$

(d) The length of $\overline{CB}$

Solution

(a) AD = |D – A| =|11 – 1| = 10 length units.

(b) BD = |D – B| = |11 – 6| = 5 length units.

(c) CA = |A – C| = |1 – 9| = – 8 length units.

(d) CB = |B – C| = |6 – 9| = – 3 length units.

Solved Example 2

From the opposite figure, find:



(a) The length of $\overline{XZ}$

(b) The length of $\overline{YZ}$

(c) The length of $\overline{ZX}$

(d) The length of $\overline{ZY}$

Solution

(a) XZ = |Z – X| = |7 – 2| = 5 length.

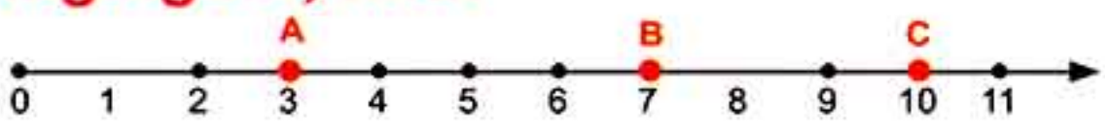
(b) YZ = |Z – Y| = |7 – 5| = 2 length.

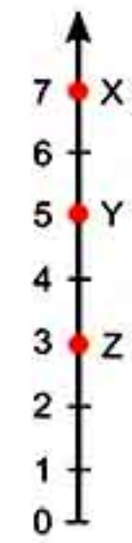
(c) ZX = |X – Z| = |2 – 7| = 5 length.

(d) ZY = |Y – Z| = |5 – 7| = 2 length.

Check Point

From the following figure, find:





a) The length of $\overline{AB}$

b) The length of $\overline{AC}$

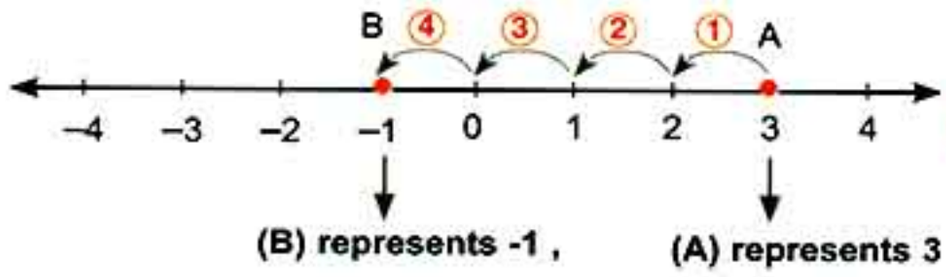
c) The length of $\overline{XZ}$

b) The length of $\overline{YX}$

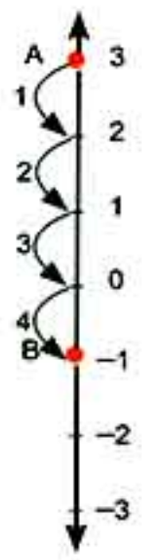
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Second The distance between two points on a straight line:

For example:



or



We can get the length of $\overline{AB}$ as follows:

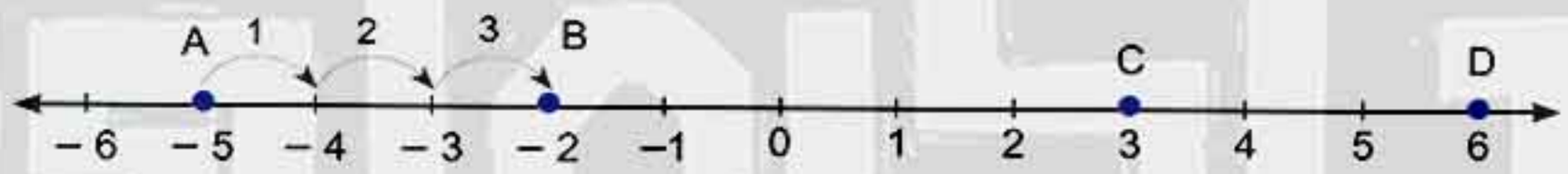
$AB = |B - A| = |-1 - 3| = |-4| = 4$ length units.

Note that

- $|A - B| = |B - A|$, then $|3 - (-1)| = |(-1) - 3| = 4$
- You can get the length of $\overline{AB}$ by counting the units between A and B.

Solved Example 3

If the points A, B, C and D represent the numbers – 5, – 2, 3 and 6 respectively, ***find the length of each of the following: $\overline{AB}$, $\overline{BC}$, $\overline{BD}$, $\overline{AD}$***



Solution

ⓐ The length of $\overline{AB}$ $= |-2 - (-5)| = |-2 + 5| = |3| = 3$ length units.

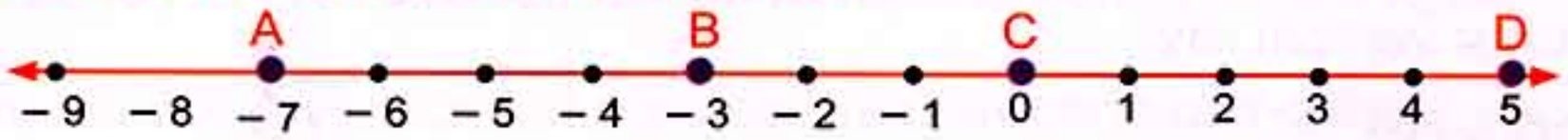
ⓑ The length of $\overline{BC}$ $= |3 - (-2)| = |3 + 2| = |5| = 5$ length units.

ⓒ The length of $\overline{BD}$ $= |6 - (-2)| = |6 + 2| = |8| = 8$ length units.

ⓓ The length of $\overline{AD}$ $= |6 - (-5)| = |6 + 5| = |11| = 11$ length units.

Check Point

From the following figure, complete:



a) AB = ... **b)** AC = ... **c)** BD = ...

d) CD = ... **e)** AD = ... **f)** BC = ...

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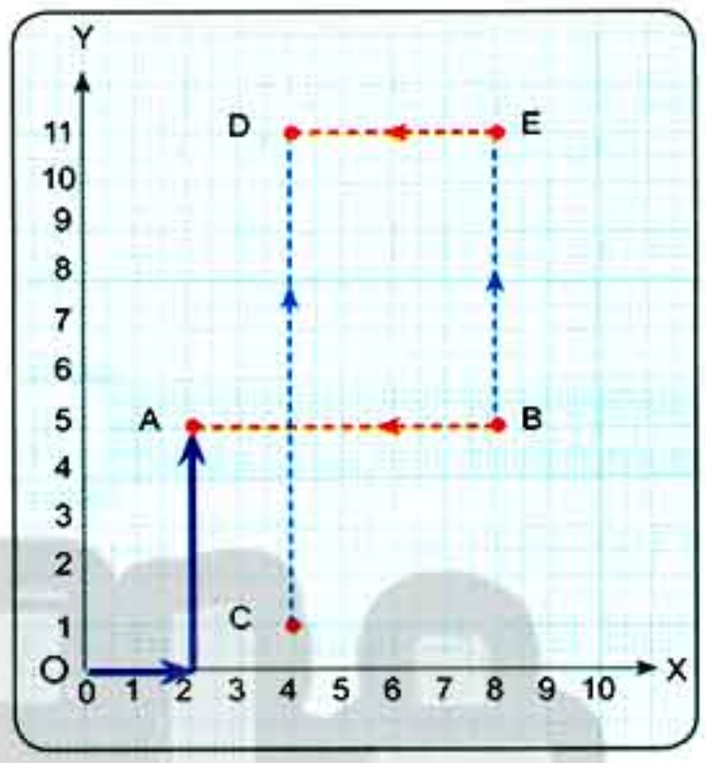
Third The distance between two points on the coordinate plane ℕ.

Notice the following:

- The opposite figure represents the union of the horizontal ray $\overrightarrow{OX}$ and the vertical ray $\overrightarrow{OY}$ which is called the coordinate plane of ℕ.
- Any point on the plane is determined by a unique ordered pair as: (1st coordinate, 2nd coordinate).

 To graph A (2 , 5):

 ❶ Start at "o" ❷ Move two units to the right ❸ Move 5 units up.



- From the opposite figure the point C is written as C (4 , 1) also B (8 , 5) , D (4 , 11) and E (8 , 11).
- To calculate the distance between two points in the coordinate plan of N, follow these steps:

 1) Determine the line segment joining between these two points as: $\overline{AB}$ where A (2 , 5) and B (8 , 5).

 2) If it is parallel to $\overrightarrow{OX}$, then we calculate this distance as on a horizontal ray.

 $\because \overline{AB} \parallel \overrightarrow{OX}$

 $\therefore$ AB = |1st coordinate of B – 1st coordinate of A| =| 8 – 2| = 6 units.

 3) If it is parallel to $\overrightarrow{OY}$ as $\overline{CD}$ where C(4,1), D(4 , 11), then we calculate as on a vertical ray.

 $\because$ CD // $\overrightarrow{OY}$

 $\therefore$ CD = |2nd coordinate of D – 2nd coordinate of C| = | 11 – 1| = 10 units.

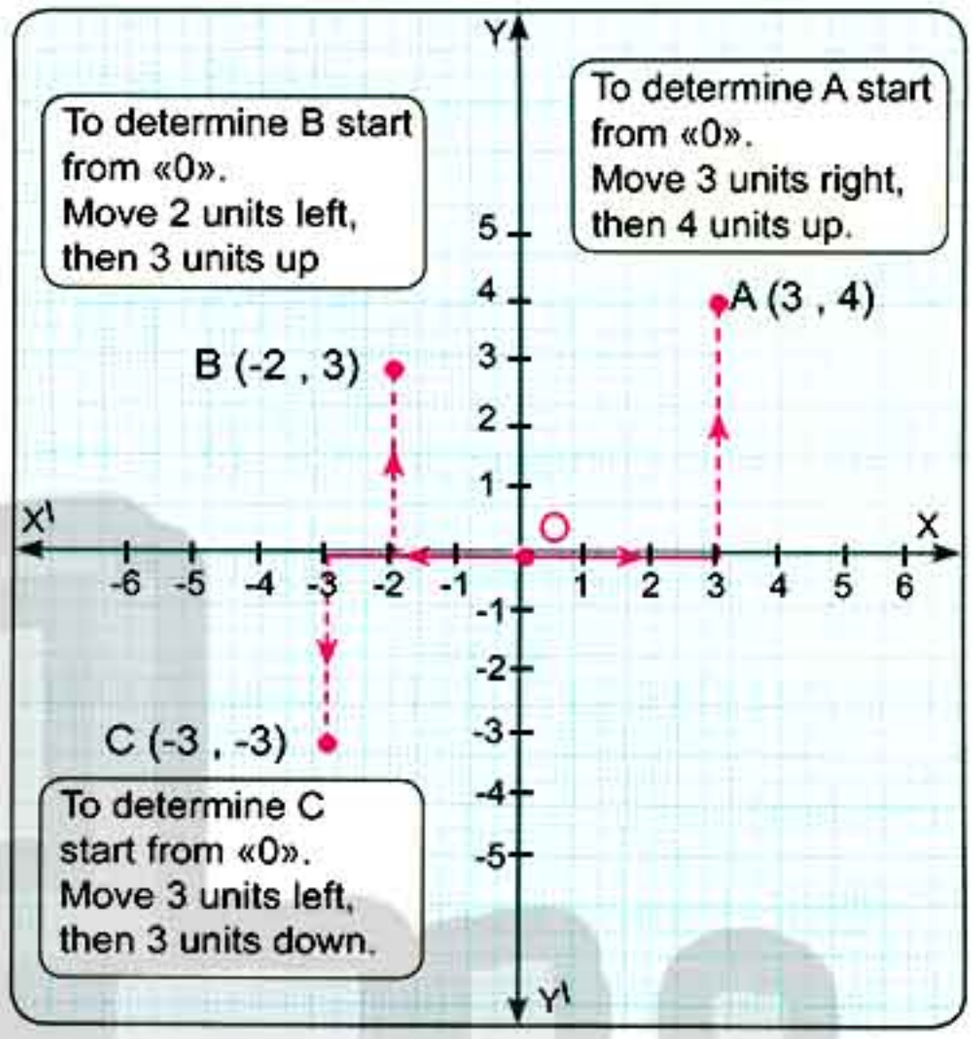
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Fourth The distance between the two points on the coordinate plane ℤ.

Notice the following:

- The opposite figure represents the union of the horizontal straight line $\overleftrightarrow{XX'}$ and vertical straight line $\overleftrightarrow{YY'}$ and that is called: the coordinate plane of ℤ.



- Any point on this plane is determined by a unique ordered pair (X , Y) where $X \in \mathbb{Z}$ and $Y \in \mathbb{Z}$.
- In the point A (3, 4), 3 is taking on $\overleftrightarrow{XX'}$ and 4 is taking on $\overleftrightarrow{yy'}$, B (–2, 3), –2 is on $\overleftrightarrow{XX'}$ and 3 is on $\overleftrightarrow{YY'}$ Also in C (–3, –3)
- $\overleftrightarrow{XX'}$ is called x-axis.
- $\overleftrightarrow{YY'}$ is called y-axis.
- The direction of $\overrightarrow{OX}$ is called the positive direction of X-axis while the direction of $\overrightarrow{OX'}$ is called the negative direction of X-axis.
- The direction of $\overrightarrow{OY}$ is called the positive direction of Y-axis while the direction of $\overrightarrow{OY'}$ is called the negative direction of Y-axis.

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Calculating the distance between two points in the coordinate plane ℤ.

To calculate the distance between two points in the coordinate plane ℤ follow these steps:

step ❶ → determine the line segment joining these two points.

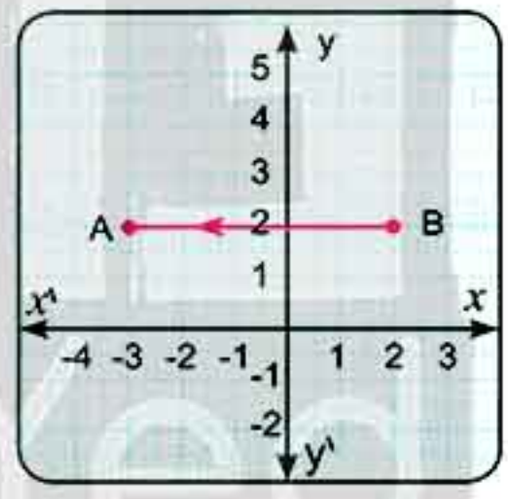
step ❷ → If it is parallel to $\overleftrightarrow{XX'}$ (X - axis), then we calculate the distance as on the horizontal straight line.

or if it is parallel to $\overleftrightarrow{YY'}$ (Y - axis), then we calculate the distance as the vertical straight line

First: **Calculating the distance between two points A and B where $\overline{AB}$ // X-axis in the coordinate plane ℤ :**

For example:

To calculate the distance between the two points A (– 3 , 2) and B (2 , 2).



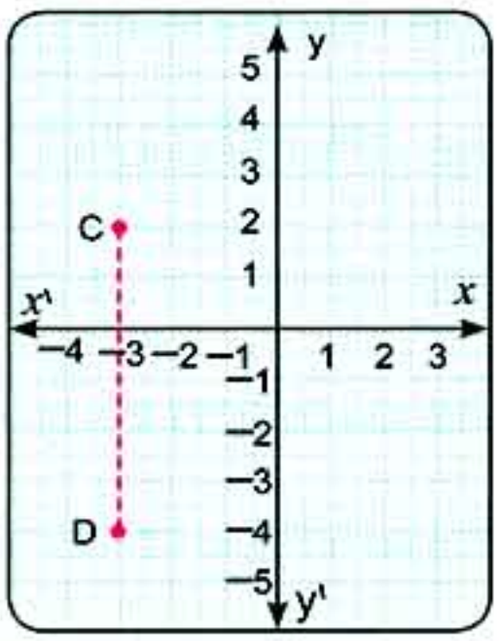
Then AB = |the 1st coordinate of B – the 1st coordinate of A|

= |2 – (–3)| = | 5 | = 5 length units.

Second: **Calculating the distance between two points C and D where $\overline{CD}$ // Y-axis in the coordinate plane ℤ :**

For example:

To calculate the distance between the two points C (–3, 2) and D (–3 ,– 4).



Then CD = | the 2nd coordinate of D – the 2nd coordinate of C|

= | (– 4) – 2 | = | – 6| = 6 length units

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Solved Example 4

Represent the following points: A (5 , 4), B (5 , – 2), C (– 3 , – 2) and D (– 3 , 4). On the coordinates plane, then:

(a) Calculate the length of each of:

1) $\overline{AB}$, $\overline{CD}$ 2) $\overline{AD}$, $\overline{BC}$

(b) Calculate the area of the shape ABCD, is it symmetric or not?

Solution

(a) 1) A (5 , 4), B (5 , – 2), ∵ $\overline{AB}$ is parallel to Y–axis,

∴ AB = |(– 2) – 4| = |– 6|

= 6 length units; C (– 3 , – 2) , D (– 3 , 4),

∵ $\overline{CD}$ is parallel to Y-axis,

∴ CD = |4 – (– 2)| = |6|

= 6 length units.

2) A (5 , 4) , D (– 3 , 4), ∵ $\overline{AD}$ is parallel to X-axis,

∴ AD = |– 3 – 5| = |– 8|

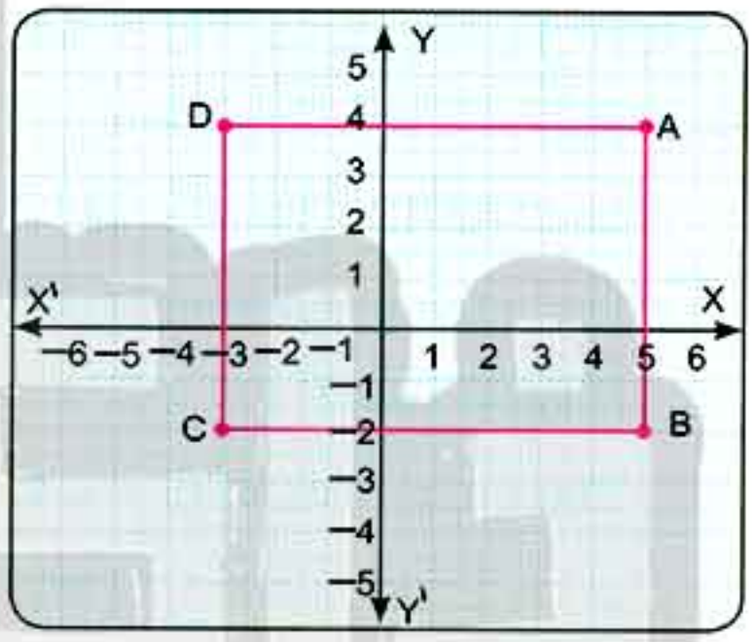
= 8 length units.

, B = (5 , – 2) , C (– 3 , – 2),

∵ $\overline{BC}$ is parallel to X-axis.

∴ BC = |– 3 – 5| = |– 8|

= 8 length units.



(b) The shape is a rectangle and its area = 8 × 6 = 48 square units and it is a symmetric figure.

Check Point

Represent the following points: A (5 , –1), B (5 , 3), C (–2 , 3) and D (–2 , –1) on the coordinate plane, then:

a) Calculate the length of each of: 1) $\overline{AB}$, $\overline{CD}$. 2) $\overline{AD}$, $\overline{BC}$.

b) Find the area of the figure.

c) Is it symmetric or not?

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Solved Example 5

Represent the following points: A (3, 2), B (2, –1), C (–2, –1) and D (–1 , 2) on the coordinate plane, then:

(a) Find the length of $\overline{BC}$ and $\overline{AD}$.

(b) What is the name of the shape ABCD?

(c) Find the area of the shape ABCD.

Solution

(a) BC = |(–2) – 2 | = | – 4| = 4 length units

AD = |(–1) – 3| = | – 4| = 4 length units

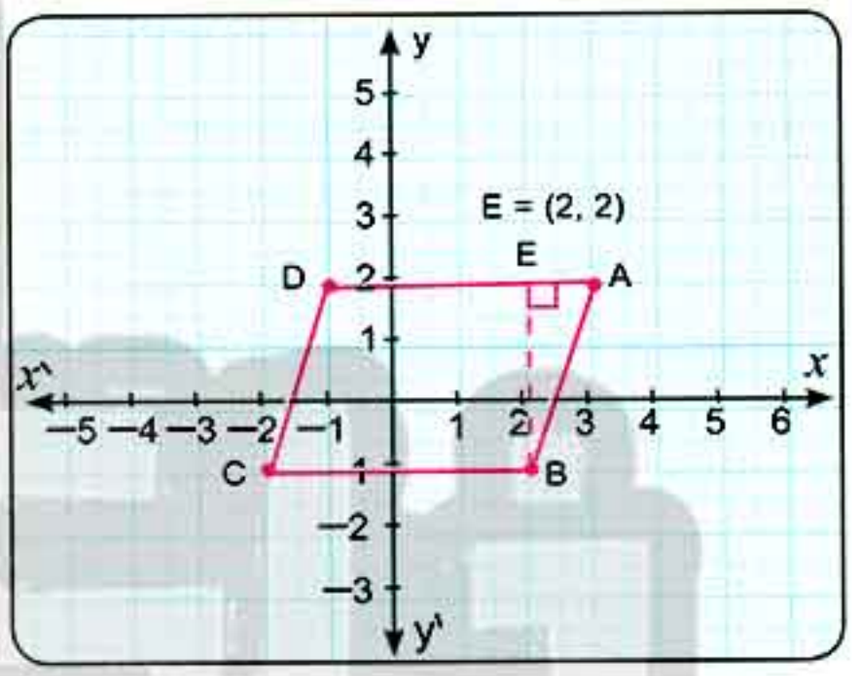
(b) ABCD is a parallelogram.

(c) Area of ABCD = base length x corresponding height

∵ From the graph height of the parallelogram is BE where E (2 , 2)

∴ The area = BC x BE = 4 x |2 – (–1)|

= 4 x 3 = 12 square units.



Check Point

Represent the following points:

A (2,0), B (5,0) , C (7,4) and D (4,4) on the coordinate plane, then:

a) Calculate the length of each of $\overline{AB}$ and $\overline{AC}$.

b) What is the name of the shape ABCD?

c) Find the area of the shape ABCD.

.....

.....

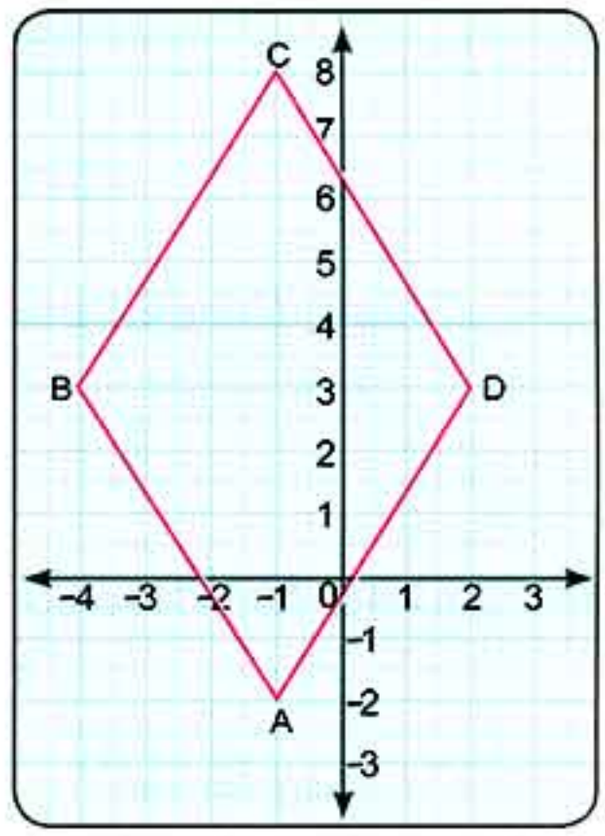
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Solved Example 6

In the opposite coordinate plane: ABCD is a rhombus.



① Find the coordinates of the points A , B , C and D

② Find the area of the rhombus ABCD.

Solution

① A (-1 , –2)

, B (– 4 , 3)

, C (–1 , 8)

, D (2 , 3)

② The length of $\overline{AC}$ = | C – A| = | 8 – (–2)| = | 8 + 2 | = |10| = 10 units.

The length of $\overline{BD}$ = | D – B| = | 2 – (–4)| = | 2 + 4 | = |6| = 6 units.

The area of the rhombus ABCD = $\frac{1}{2}$ × AC × BD = $\frac{1}{2}$ × 10 × 6 = 30 square units.

Check Point

On the following coordinate plane: ABCD is a rhombus.

a) Complete the following:

A (..... , ...) and B (..... , ...).

C (..... , ...) and D (..... , ...).

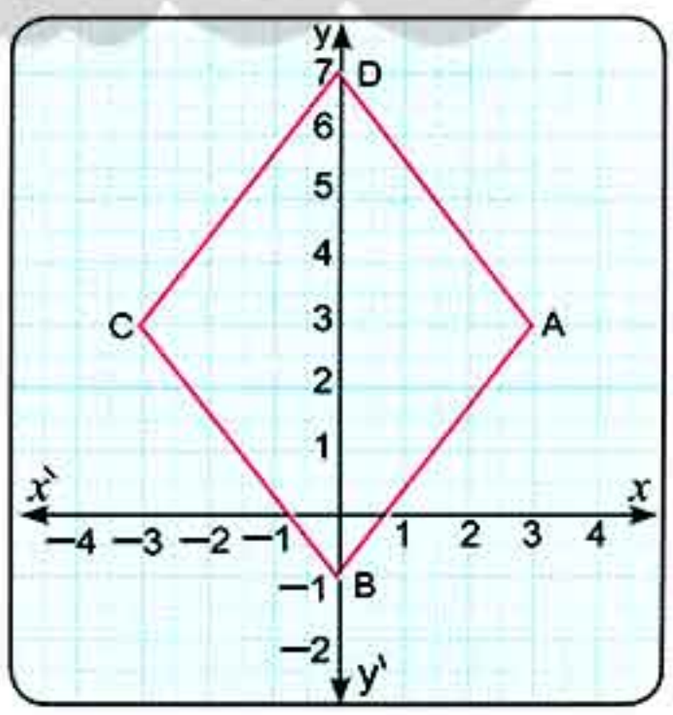
b) The area of the rhombus can be calculated by using the length of its two perpendicular diagonals, where:

AC = | | = | | = ... length units

BD = | | = | | = ... length units

The area of the rhombus = $\frac{1}{2}$ × ×

= square units



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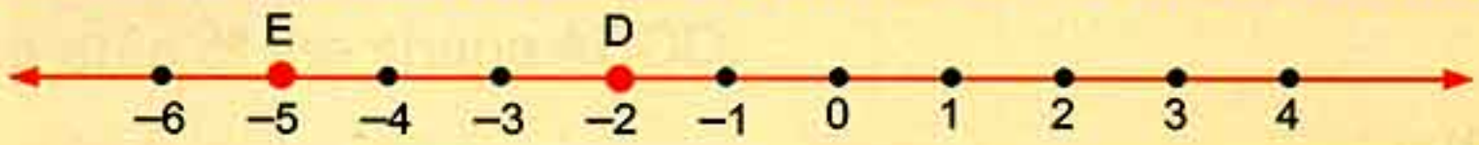
EXERCISE 1

Distance between two points on the coordinate plane

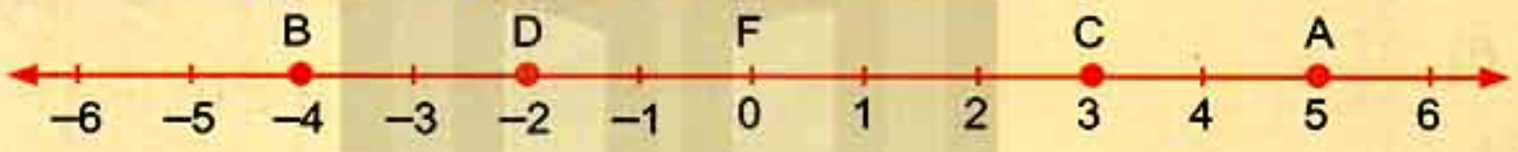
1 *Calculate the distance between the two points A and B on the following straight line:*



2 *Calculate the distance between the two points D and E on the following straight line:*



3 *On the following straight line, calculate:*



a) The distance between A and B.
b) The distance between D and C.
c) The distance between C and B.
d) The distance between D and F.

4 *Using the following figure which represents the number line of integer, complete as in (a):*



a) The length of $\overline{AB}$ = $|3 - 6|$ = $|-3|$ = 3 length units.

b) The length of $\overline{AC}$ = |.....| = |.....| = ... length units.

c) The length of $\overline{DA}$ = |.....| = |.....| = ... length units.

d) The length of $\overline{DB}$ = |.....| = |.....| = ... length units.

e) The length of $\overline{DF}$ = |.....| = |.....| = ... length units.

f) The length of $\overline{DC}$ – the length of $\overline{BA}$ = |.....| – |.....| = |.....| – |.....|
= length units.

g) The length of $\overline{DC}$ + the length of $\overline{FB}$ = |.....| + |.....| = |.....| + |.....|
= length units.

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5 Using the opposite figure complete:



a) The length of $\overline{AD}$ = |.....| = |.....| = ... length units.

b) The length of $\overline{AF}$ = |.....| = |.....| = ... length units.

c) The length of $\overline{FD}$ = |.....| = |.....| = ... length units.

d) The length of $\overline{FD}$ + the length of $\overline{BF}$ = |.....| + |.....|

= |.....| + |.....| = ... length units.

e) Is the length of $\overline{CD}$ equal to the length of $\overline{BF}$?

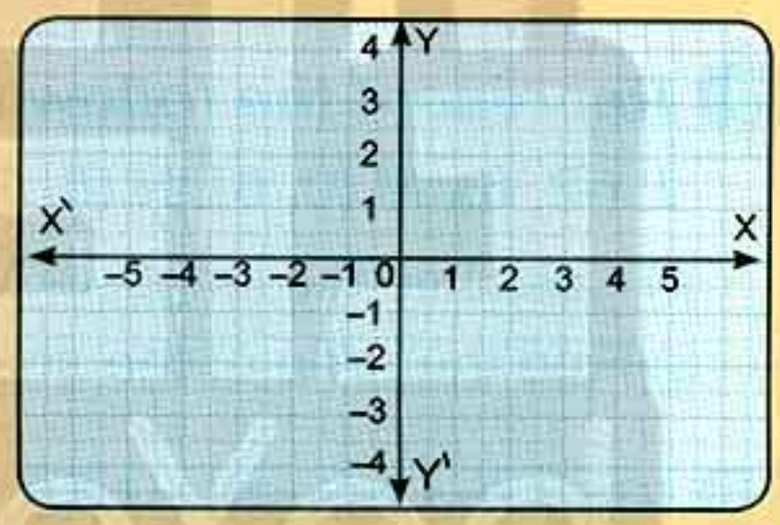
f) The length of $\overline{CF}$ = |.....| = |.....| = ... length units.

g) The length of $\overline{AB}$ + the length of $\overline{CD}$ = |.....| + |.....|

= |.....| + |.....| = ... length units.

6 ***Using the opposite figure answer the following:***

a) Determine the points A, B, C and D, where
A (0, 3), B (–2, 0), C (0, –3) and D (2, 0).



b) The length of $\overline{AC}$ = ...

= length units.

c) The length of $\overline{DB}$ = ...

= length units.

d) What is the name of the shape ABCD?

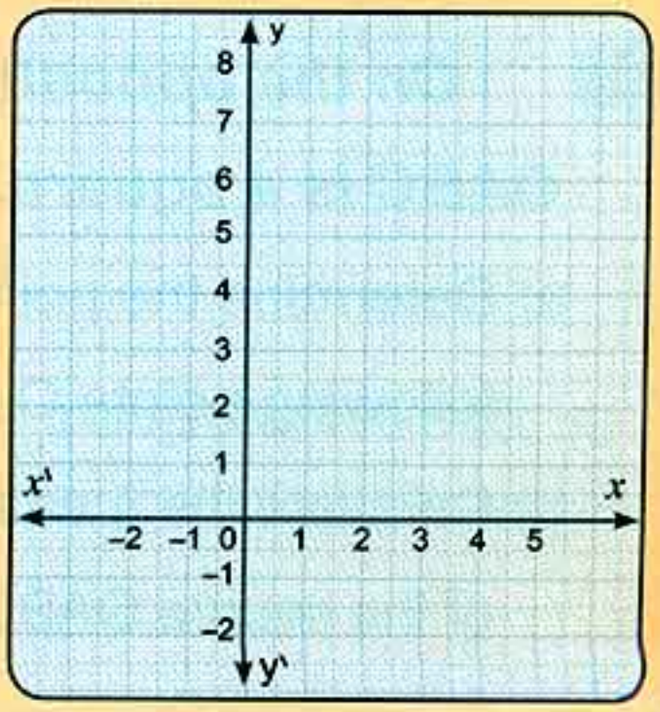
e) Find the area of the shape ABCD.

7 🕮 ***On the opposite coordinate plane:***

a) Determine the points L (–1, 1),
M (1, 1), N (1, 8) and K (–1, 8).

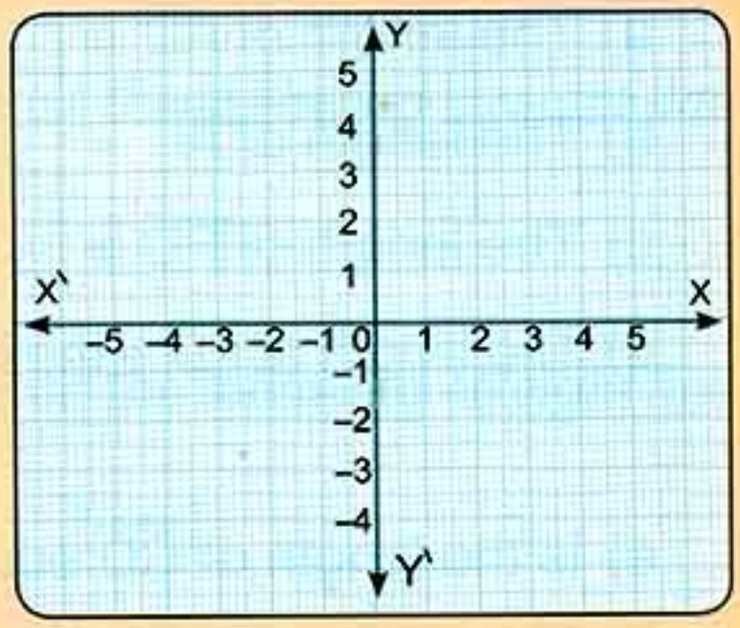
b) Find the perimeter and area of
the shape LMNK.

c) Determine whether the shape
is symmetric or not and say why?



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8 ***Using the opposite figure answer the following:***



a) Determine the points A (2, 4), B (2, –2) , C (–2, –2) and D (–2, 4).

b) ***Complete:***

The length of $\overline{AB}$ = |.....| = |.....|

= length units.

The length of $\overline{BC}$ = |.....| = |.....|

= length units.

The length of $\overline{CD}$ = |.....| = |.....| = ... length units.

The length of $\overline{DA}$ = |.....| = |.....| = ... length units.

c) What is the name of the shape ABCD?

d) Find the area of the shape ABCD.

9 ***Represent the following points:***

L (-2, 6), M (0, 6), N (5, 11) and K (-2, 11) on the coordinate plane.

a) Calculate the length of $\overline{ML}$, $\overline{NK}$.

b) What is the name of the shape LMNK?

c) Find the area of the shape LMNK.

10 ***Find the length of $\overline{AB}$ in each of the following:***

a) A (-2, 5), B (4, 5)

b) A (3, 7), B (8, 7)

c) A (-6, 2), B (-4, 2)

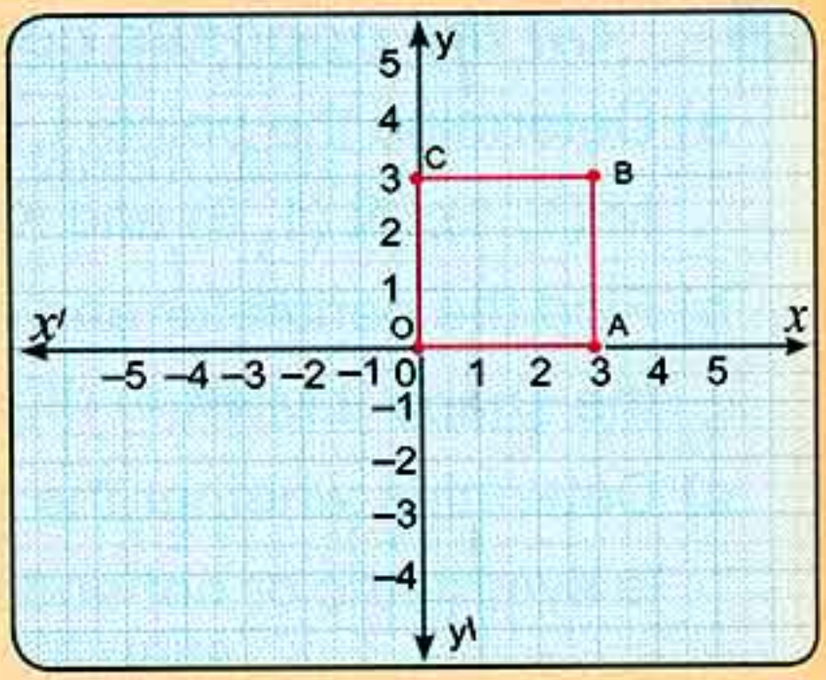
d) A (13, 8), B (-5, 8)

11 📖 ***On the opposite coordinate plane:***

OABC is a square.

a) Determine the points of each of the following points O, A, B and C.

b) Calculate the area and the perimeter of the square OABC.



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12 On the opposite coordinate plane:

ABCD is a rhombus.

a) Complete the following:

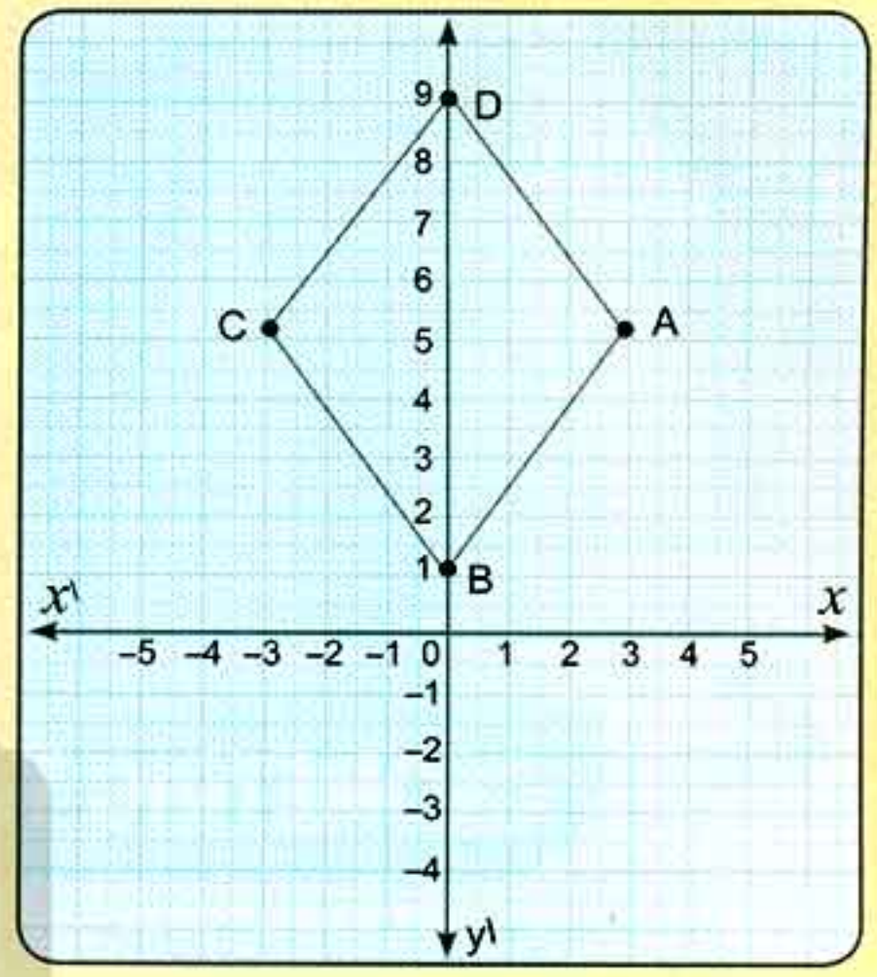
A (.....,.....) and B (.....,.....).

C (.....,.....) and D (.....,.....).

b) The area of the rhombus can be calculated by using the lengths of its two perpendicular diagonals, where:

AC = |.....| = |.....| = ... length units.

BD = |.....| = |.....| = ... length units.



The area of the rhombus = $\frac{1}{2}$ x x = ... square units.

Cumulative Exercise

13 In the opposite coordinate plane:

Determine the position of the following points:

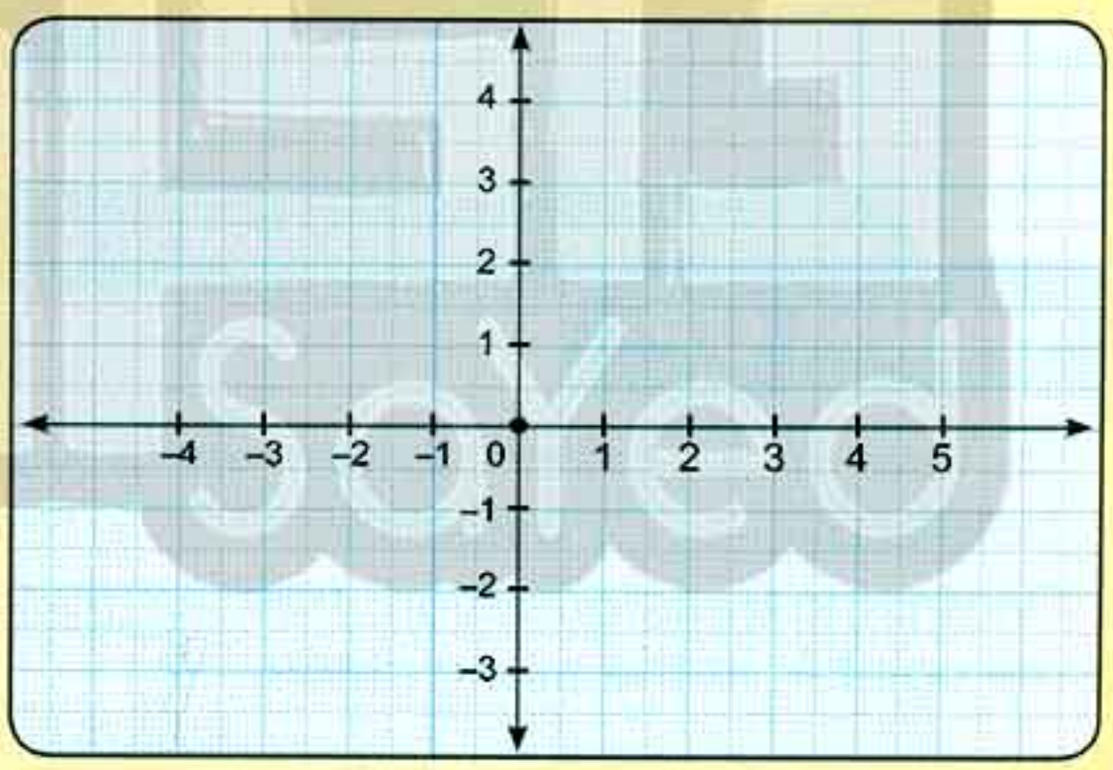
A (3 , 4), B (-4 , 4) and C (3 , -2)

then find:

1) The length of $\overline{AB}$ And $\overline{AC}$.

2) What is the type of the triangle ABC with respect to its sides and its angles.

3) The area of the triangle ABC.



Think and Explore

14 In the coordinate plane, the triangle ABC is right- angled triangle where A (5 , 4) , B (5 , 2) and C (–1 , K), if its area units = 6 square units, then find the length of $\overline{BC}$ and the value of K.

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2 Lesson

GEOMETRIC TRANSFORMATION (TRANSLATION)

Aims

At the end of this lesson, you will be able to:

(1) recognise the concept of the geometric transformation and the concept of translation.

(2) gain the skill in finding the image of a point and a geometric shape by translation in the coordinate plane.

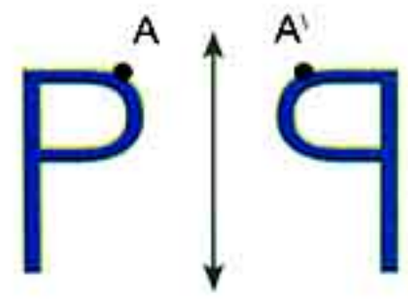
WARM UP

watch video

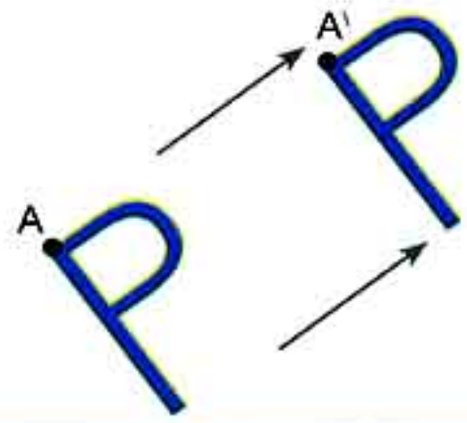
You have studied before that there are "3 types" of geometric transformation:

1) Reflection 2) Translation 3) Rotation

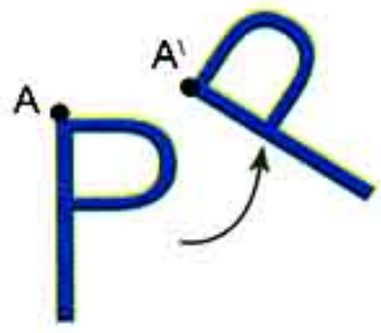
Geometric transformation: transforms (or move) each point A in the plane into the point A' in the same plane.



Reflection



Translation



Rotation

The geometrical transformation change the position of each point of "P".

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You have studied before in details the reflection but, now we are going to study in details the translation.

Translation:

Prelude:

In the opposite figure:

Hossam wants to pass the ball to Ibrahim.



It means that:

1) The ball moves in a straight line a distance (or magnitude) 3 metres from Hossam to Ibrahim (magnitude).
2) The ball goes to the direction of Ibrahim.Then Hossam needs to make a translation.

Definition:

Translation: is a geometric transformation that transforms each point A in the plane to an image A' in the same plane, with a certain same direction and with a constant (distance or magnitude). Then any translation in the plane is determined by: a magnitude and a direction.

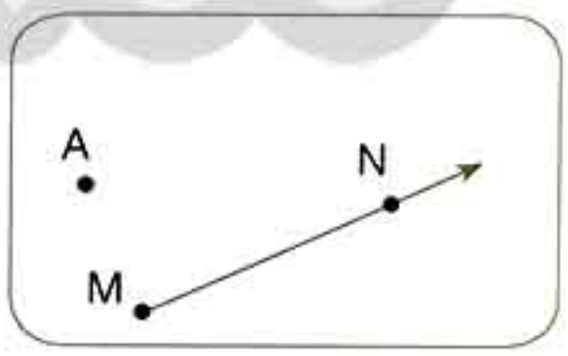
First Translation in the plane:

a) How to draw the image of a point by a certain translation:

Solved Example 1

In the opposite figure:

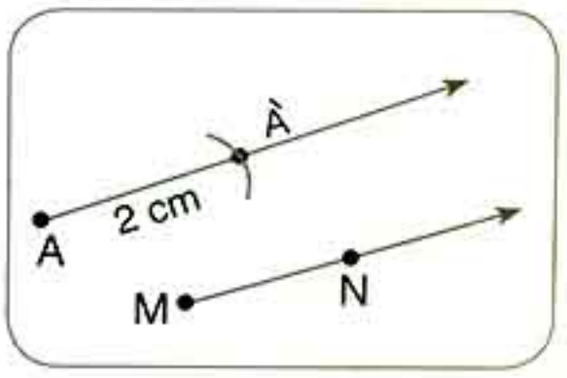
A is a point in the plane, $\overrightarrow{MN}$ where $A \notin \overrightarrow{MN}$. Draw the image of A by translation in the direction $\overrightarrow{MN}$ with magnitude equal to 2 cm.



Solution

We do as follows:

1) We draw from A a ray parallel to $\overrightarrow{MN}$ in the same direction.
2) Put the pin of your compass in A and with a distance 2 cm draw an arc of a circle to intersect the ray drawn from A to get the point $\grave{A}$, where $A\grave{A} = 2$ cm and $\overrightarrow{A\grave{A}} \,//\, \overrightarrow{MN}$



Thus: $\grave{A}$ is the image of A by translation of magnitude 2 cm in the direction of $\overrightarrow{MN}$.

fixed	ثابت	magnitude	مقدار	certain direction	اتجاه محدد

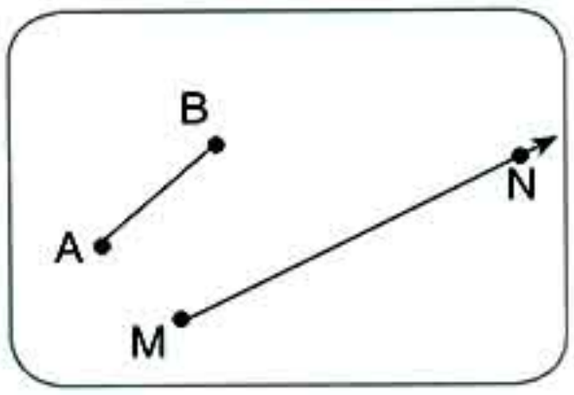
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b) How to draw the image of a line segment by a certain translation:

Solved Example 2

In the opposite figure:

AB is a line segment in the plane and MN is a ray in the plane $\left(\text{where } \overline{AB} \not\subset \overrightarrow{MN}\right)$ draw the image $\overline{A'B'}$ of $\overline{AB}$ by translation in the direction of $\overrightarrow{MN}$ with magnitude equal to 2 cm.



Solution

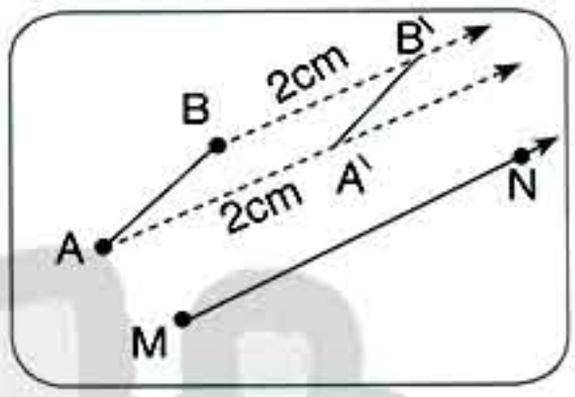
We do as follows:

1) Draw the image of the point A by the translation of magnitude 2 cm in the direction of $\overrightarrow{MN}$ as in the previous example.

2) By the same way draw the image of B by translation of magnitude 2 cm in the direction of $\overrightarrow{MN}$.

- Join $\overline{A'B'}$

3) Thus the image of $\overline{AB}$ is $\overline{A'B'}$.



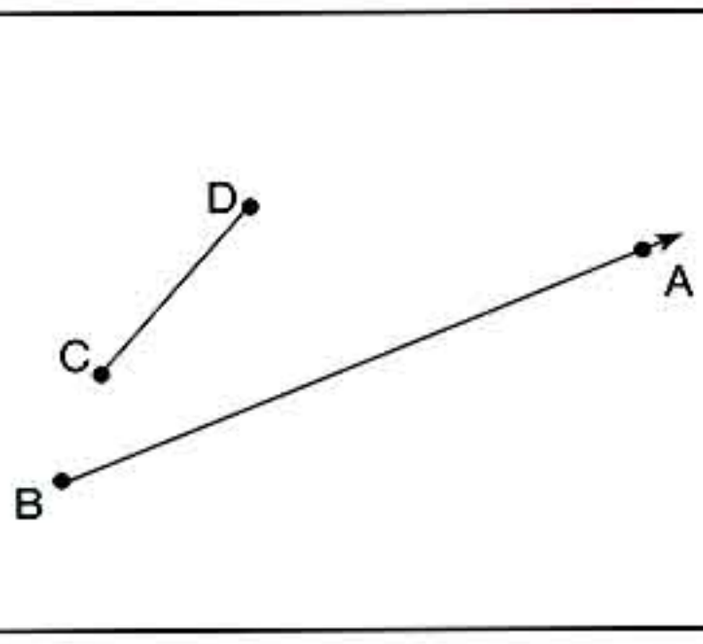
Note that

You can check that

$AB = A'B'$ and $\overline{AB} \parallel \overline{A'B'}$.

Check Point

Find the image of $\overline{CD}$ by translation with magnitude 3 cm in the direction of $\overrightarrow{BA}$:



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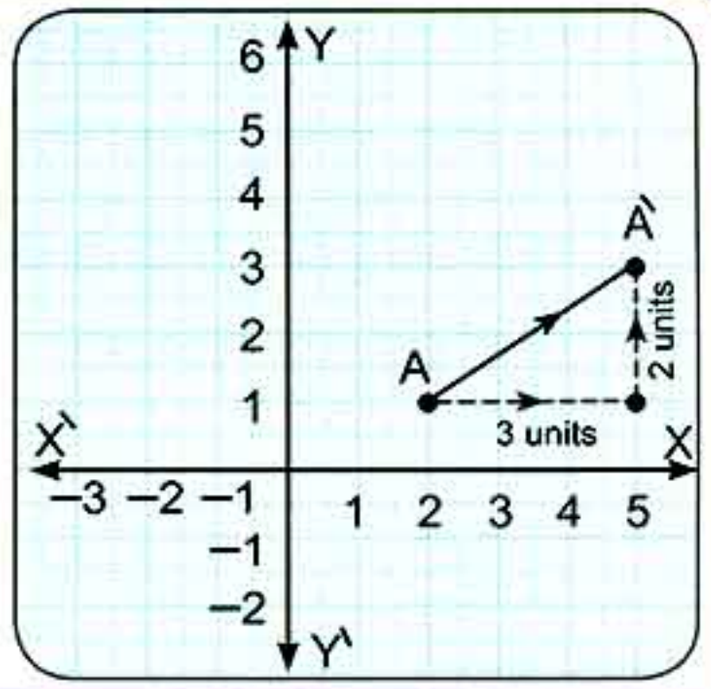
Second The translation in the coordinate plane Z:

a) Translation of a point:

Consider the point A (2 , 1), then to get its image in the coordinate plane by a translation (3 , 2), then: move this point 3 units to the right and 2 units up.

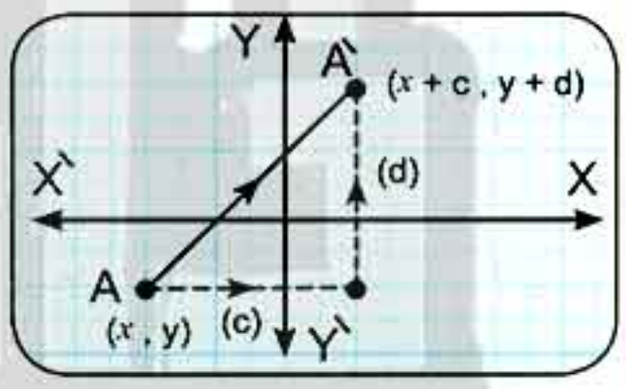
So, A $(\overset{x}{2} , \overset{y}{1}) \xrightarrow[(2+3 ,1+2)]{(3 , 2)}$ Â (5 , 3), then:

image of A (2 , 1) by translation (3 , 2) is Â (5 , 3).



In general:

The translation in the coordinate plane transforms each point A to a point Â in the same plane by displacement it "c" units in the direction of X-axis followed by displacement "d" units in the direction of Y-axis:



i.e. A $(x, y) \xrightarrow{\text{Translation (c, d)}}$ Â $(x + c , y + d)$

Solved Example 3

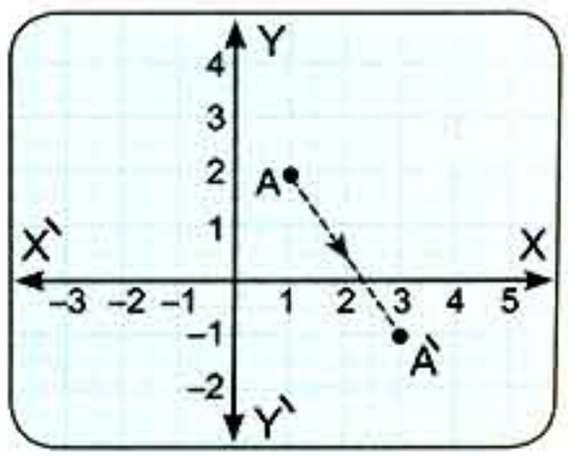
In the opposite figure: Find the image of A (1, 2) by translation (x + 2 , y – 3).

Solution

A (1 , 2) $\xrightarrow{\text{Translation (2, – 3)}}$ Â (1 + 2 , 2 – 3) =A' (3 , –1).

Note that: The image of "A" by translation (x + 2 , y – 3) could be expressed also as follows:

The image of A (1 , 2) by translation (2 , – 3) is A' (3 , –1).



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b) Translation of a line segment in the coordinate plane:

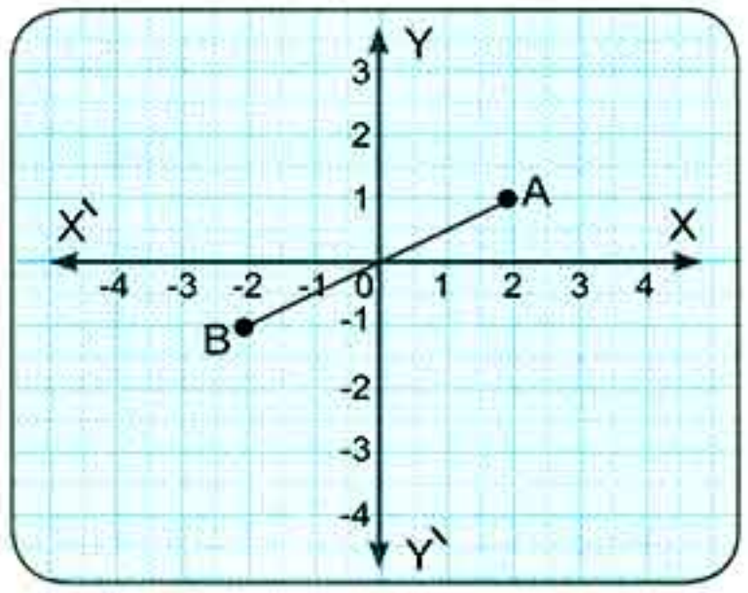
Solved Example 4

In the opposite figure:

Find the image of the line segment AB,

where: A (2, 1), B (–2, –1)

by the translation $(x + 3, y - 2)$.



Solution

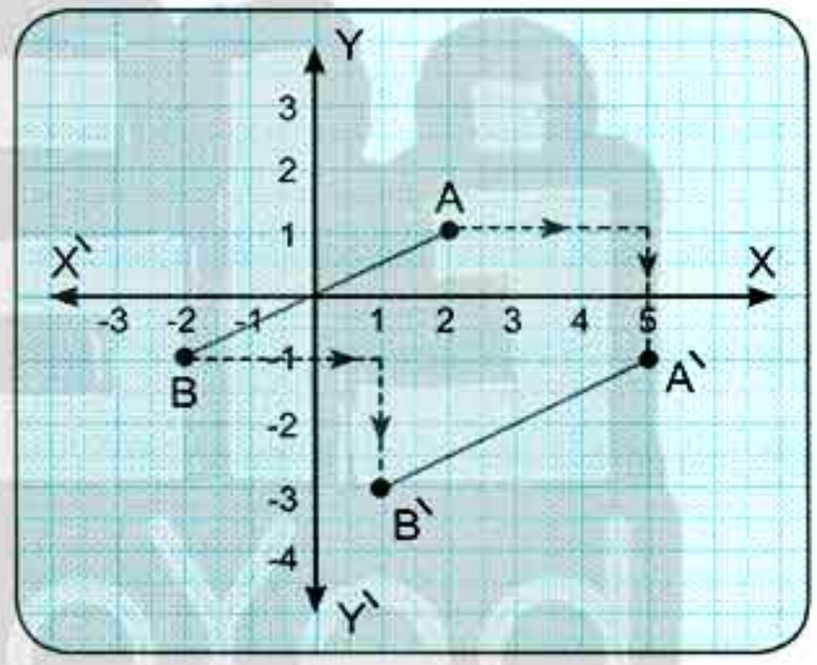
∵ Translation is the displacement of 3 units
in the positive direction of X-axis and 2 units
in the negative direction of Y-axis.

∴ A (2 , 1) $\xrightarrow{\text{Translation } (3\ ,\ -2)}$ A` (5 , –1)

∴ B (–2 , –1) $\xrightarrow{\text{Translation } (3\ ,\ -2)}$ B` (1 , –3)

∴ $\overline{\text{A`B`}}$ is the image of $\overline{\text{AB}}$ by translation $(x + 3 , y - 2)$

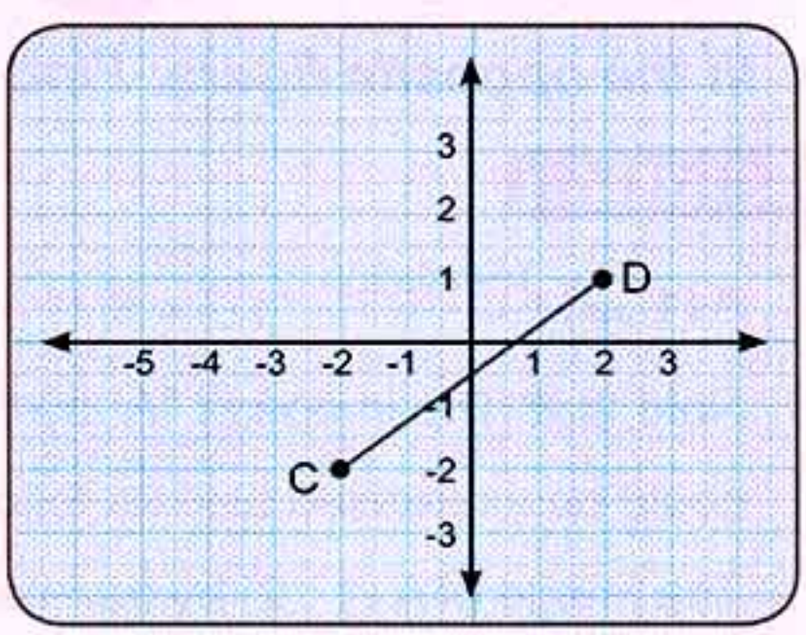
i.e. A`B` = AB , $\overline{\text{A`B`}}$ // $\overline{\text{AB}}$.



Check Point

Find the image of line segment $\overline{CD}$ where:

C (– 2 , –1) , D (2 , 1) by translation (x – 3 , y + 2)



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c) translation of a geometric figure in the coordinate plane:

Solved Example 5

In the opposite figure:

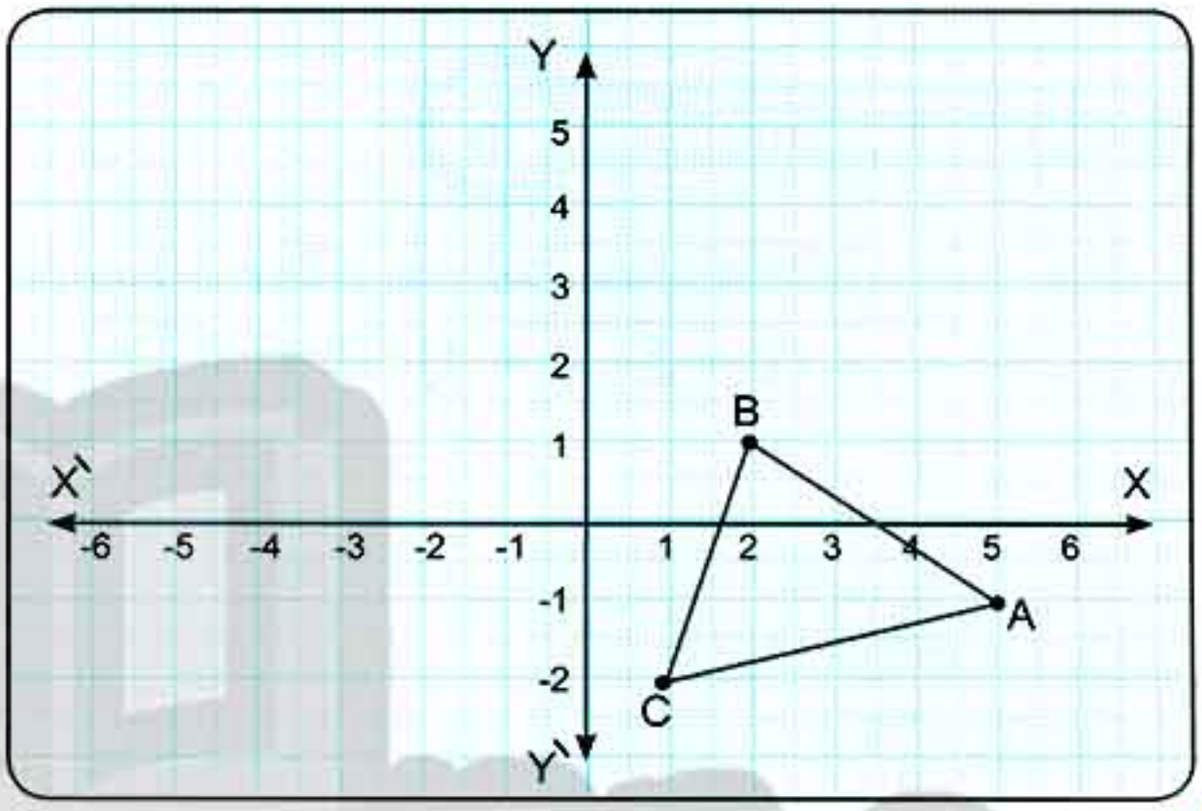
ABC is a triangle in which

A (5 , –1) , B (2 , 1) and C (1 , – 2).

Find the image of the triangle

ABC by translation

$(x , y) \longrightarrow (x - 4 , y + 2)$.



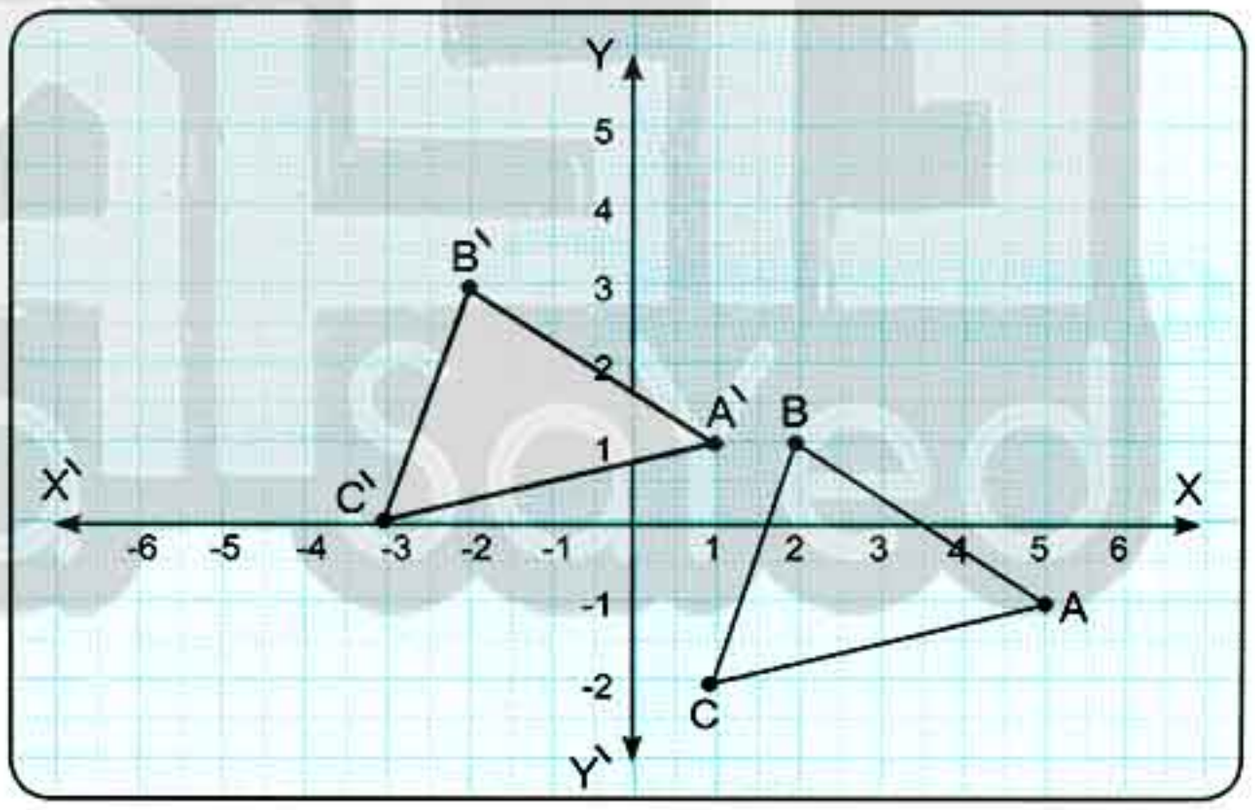
Solution

A (5 , –1) $\xrightarrow{(-4 , 2)}$ A` (1 , 1)

B (2 , 1) $\xrightarrow{(-4 , 2)}$ B` (– 2 , 3)

C (1 , – 2) $\xrightarrow{(-4 , 2)}$ C` (– 3 , 0)

Determine the points A`, B`, C`, then draw Δ A`B`C`, which is the image of Δ ABC



You can check that:

1) AB = A`B`, BC = B`C`, CA = C`A`.

2) m (∠A) = m (∠A`), m (∠B)
= m (∠B`), m (∠C)
= m (∠C`).

3) $\overline{AB} \parallel \overline{A`B`}$, $\overline{BC} \parallel \overline{B`C`}$, $\overline{AC} \parallel \overline{A`C`}$.

Check Point

In the coordinate plane:

Represent the following points: A (2,4), B (1,3) and C (1,6), then determine the image of Δ ABC by translation (x, y – 2)

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REMARK

By applying the property of addition operation

∵ the image = point + translation

∴ Point = image – translation , Translation = image – point

Solved Example 6

If A` (5 , – 3) is the image of the point A by translation whose rule is (x , y) ⟶ (x – 2 , y + 1), find A.

Solution

∵ A $(x , y) \xrightarrow{(-2 , 1)}$ A` (5 , – 3),

∴ $x – 2 = 5$, $y + 1 = – 3$

∴ $x = 7$ and $y = – 4$

∴ A (7 , – 4)

Another solution:

Point A = image of A – translation

= (5 , – 3) – (– 2 , 1) = (7 , – 4)

Note that

If (a, b) = (c , d),
then a = c
and b = d

Solved Example 7

If A (–1 , 3) and A` (4 , – 2), then find the rule of the translation.

Solution

The translation = image – original point

= (4 , – 2) – (–1 , 3)

= (4 – (–1) , – 2 – (3))

= (4 + 1 , – 2 – 3) = (5 , – 5)

Check Point

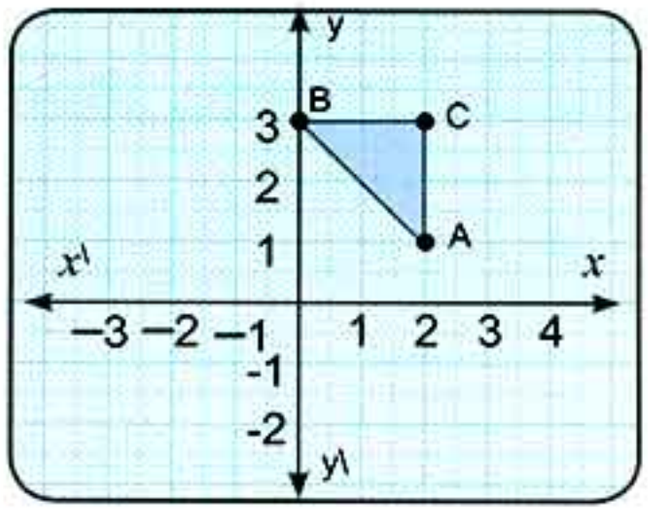
If B` (7 , – 4) is the image of point B by translation whose rule is (x , y) ⟶ (x + 2 , y – 1). ***Find B.***

.....

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Solved Example 8

Draw the image of the opposite figure by translation two steps to the right followed by one step down.



Solution

∵ A (2 , 1), B (0 , 3), C (2 , 3)

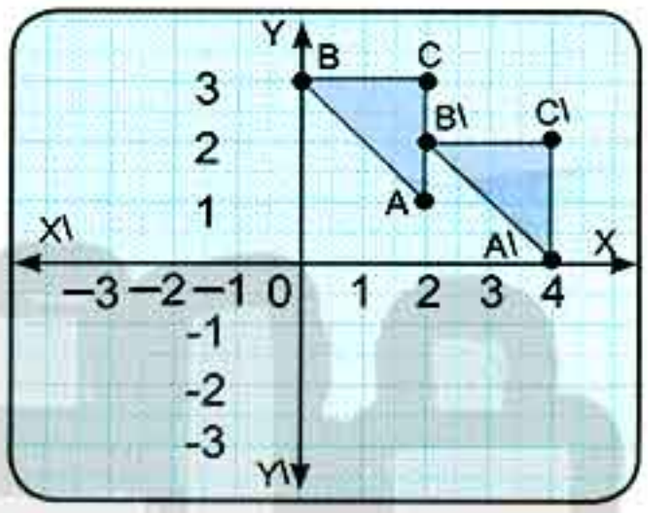
and the translation is (2 , −1), then:

∴ A` = (2 , 1) + (2 , −1) = (4 , 0)

, B` = (0 , 3) + (2 , −1) = (2 , 2)

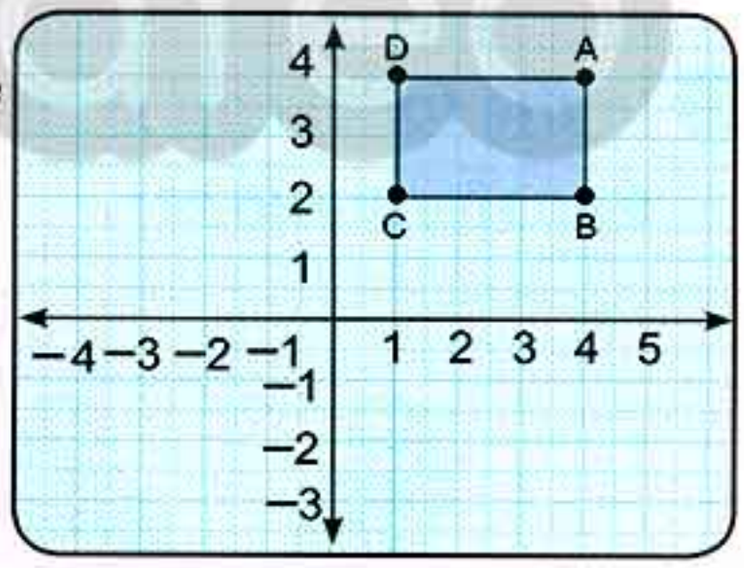
, C` = (2 , 3) + (2 , −1) = (4 , 2)

∴ the image of Δ ABC by translation 2 steps to the right followed by 1 step down is Δ A`B`C`.



Check Point

In the opposite coordinate plane determine the image of quadrilateral ABCD by translation 3 steps to the right followed by 4 steps down.



A tip: complete

∵ A` = (..... , ...) + (..... , ...) = (..... , ...)

, B` = (..... , ...) + (..... , ...) = (..... , ...)

, C` = (..... , ...) + (..... , ...) = (..... , ...)

, D` = (..... , ...) + (..... , ...) = (..... , ...)

∴ A`B`C`D` is the image of ABCD by the translation (3 , – 4)

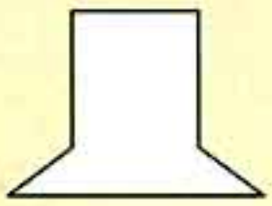
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EXERCISE 2

Geometric Transformation (Translation)

1 ***Determine which of the following shapes is symmetric and which is not symmetric, then draw the axis of symmetry (if it exists):***

a)



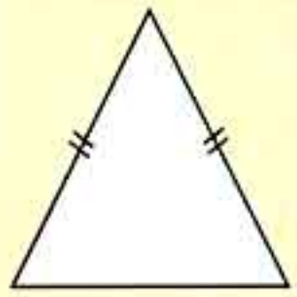
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b)



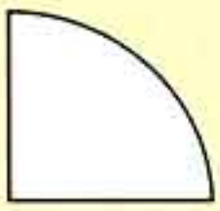
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c)



.....

d)



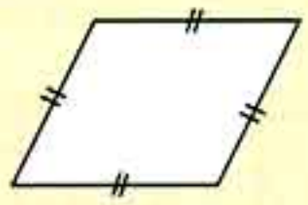
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e)



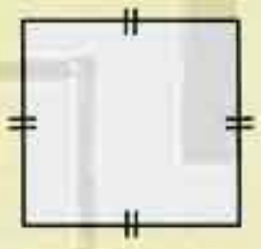
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f)



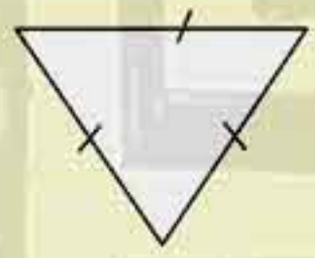
.....

g)



.....

h)



.....

i)



.....

2 ***In the following pictures determine the type of geometric transformations:***

a)



.....

b)



.....

c)



.....

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d)



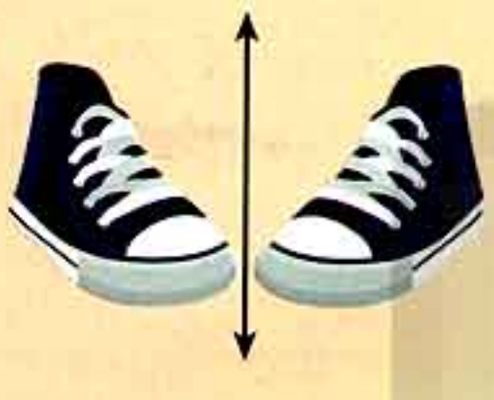
e)



f)



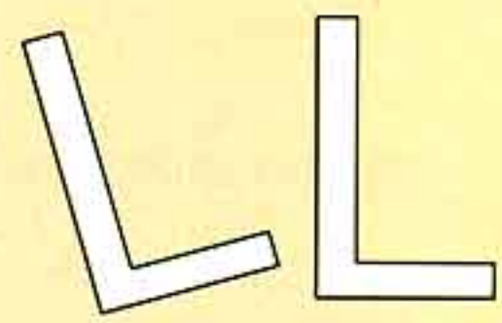
g)



h)



i)

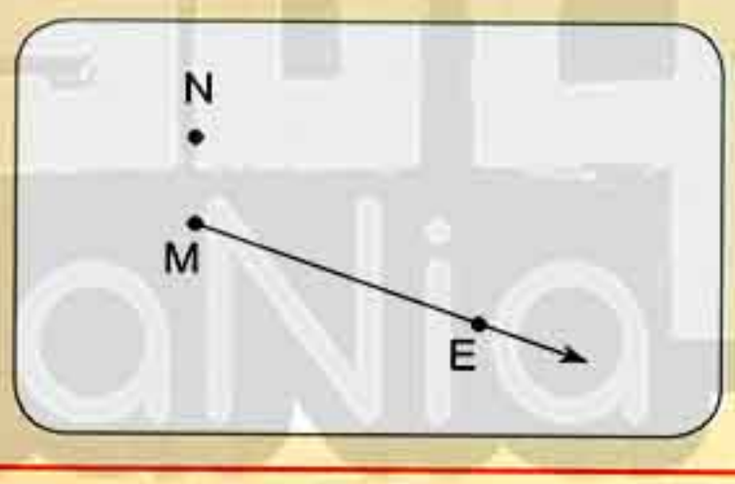


3 Using the following figures, find:

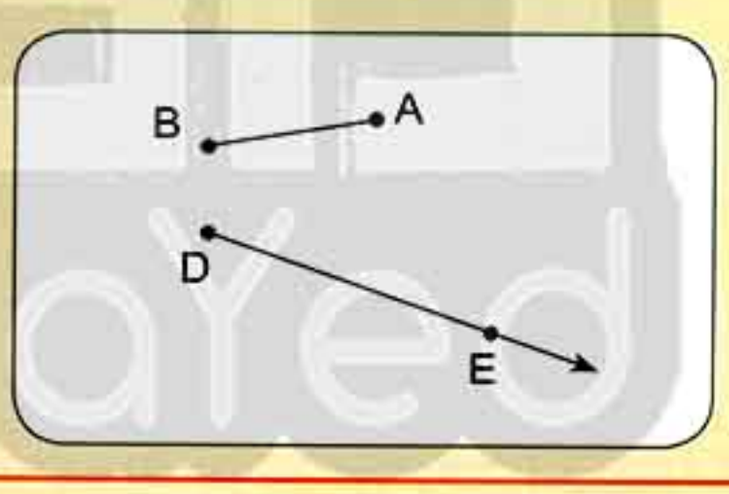
a) The image of N by translation ME (as magnitude) in the direction of $\overrightarrow{ME}$.

b) The image of $\overline{AB}$ by a translation of 3 cm in the direction of $\overrightarrow{DE}$.

1)



2)



4 Complete the following table:

	The point	The translation	The image
a)	(3 , 2)	$(x + 3 , y + 1)$	(..... , ...)
b)	(..... , ...)	$(x + 2 , y - 1)$	$(-3 , 3)$
c)	(1 , 3)	$(x -$ $, y -$ $)$	(0 , 0)
d)	$(-4 , -1)$	$(x + 3 , y + 1)$	(..... , ...)

direction اتجاه

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5 ***Choose the correct answer:***

a) The number of the axes of symmetry of an isosceles triangle is

(1 *or* 2 *or* 3 *or* 4)

b) The number of the axes of symmetry of a square is

(1 *or* 2 *or* 3 *or* 4)

c) The number of the axes of symmetry of an equilateral triangle is

(1 *or* 2 *or* 3 *or* 4)

d) The image of the point (– 2 , 3) by translation 3 units in the negative direction of Y-axis is ((– 2 , 0) *or* (– 5 , 3) *or* (– 2 , 6) *or* (– 3 , 0))

e) The image of the point (3 , – 5) by translation 4 units in the negative direction of X-axis and 4 units in the positive direction of Y-axis is

((7 , –1) *or* (7 , – 9) *or* (–1 , – 9) *or* (–1 , –1))

f) 🕮 The image of the point (–1 , 2) by translation 3 units in the positive direction of x-axis is ((–1 , 5) *or* (2 , 2) *or* (– 2 , 2) *or* (–1 , 3))

g) 🕮 The image of the point (– 3 , 4) by translation 4 units in the negative direction of Y-axis is ((– 3 , 0) *or* (– 7 , 4) *or* (– 3 , 8) *or* (–1 , 4))

h) 🕮 The image of the point (3 , 5) by translation $(x + 2 , y - 1)$ is

((5 , 6) *or* (5 , 4) *or* (1 , 4) *or* (1 , 6))

i) 🕮 The image of the point (8 , –10) by translation (– 3 , 4) is

((5 , – 6) *or* (5 , –14) *or* (11 , – 6) *or* (11 , –14))

j) 🕮 The image of the point (..... , ...) by translation $(x - 3 , y + 4)$ is (– 5 , – 3)

((– 8 , 15) *or* (– 2 , 7) *or* (– 8 , 7) *or* (– 2 , –7))

k) 🕮 The image of the point (1 , – 3) by translation (..... , ...) is (1 , 0)

((1 , 0) *or* (0 , 0) *or* (3 , 0) *or* (0 , 3))

l) The image of the point A (3 , – 4) by translation $(x + 1 , y + 4)$ is

((4 , 0) *or* (4 , 8) *or* (3 , 8) *or* (3 , 0))

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6 ***Complete the following:***

a) The image of the point A (3 , 1) by translation (–1 , 3) is (..... , ...).

b) The image of the point B (3 , 5) by translation (x + 2 , y – 1) is (..... , ...). *(Giza 2019)*

c) The image of the point A (1 , 2) by translation (x + 1 , y – 1) is (..... , ...).

d) The image of the point A (4 , 5) by translation (– 2 , 1) is (..... , ...). *(Aswan 2013)*

e) The image of the point (..... , ...) by translation (2 , 1) is (3 , 5).

f) The image of the point (..... , ...) by translation (x + 3 , y – 1) is (0 , 0).

g) The image of the point (– 2 , 6) by translation (..... , ...) is (5 , 2).

h) If the image of the point (a , b) , is (5 , – 4) by translation (2 , – 3), then the coordinates of the point (a , b) = ...

i) The image of the point A (2 , 5) by translation (x + 1 , y – 2) is *(Giza 2016)*

j) The image of the point B (2 , 5) by translation 4 units in the negative direction of X-axis is

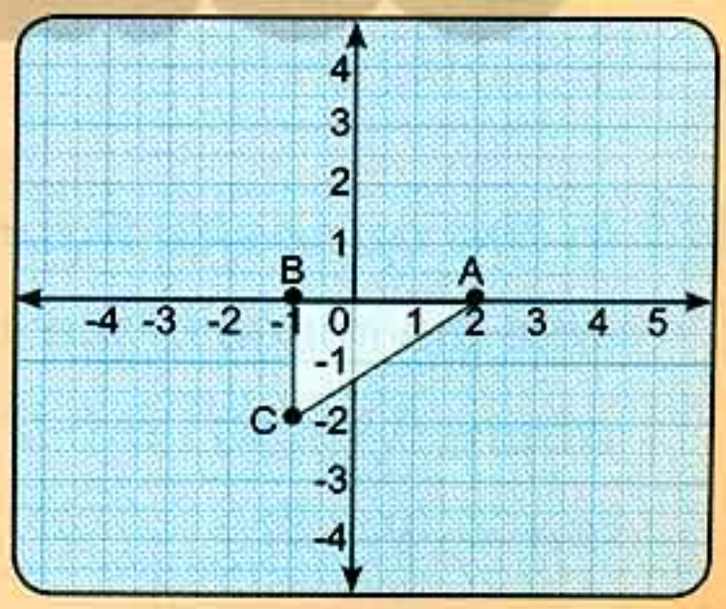
7 If the image of the point (a , b) by translation (3 , – 2) is (– 4 , 5), ***find (a , b).*** *(Alexandria 2015)*

8 ***Find*** the coordinates of the point A if its image by the translation (1 , – 5) is $\hat{A}$ (2 , 0).

9 ***From the opposite figure:***

a) Determine the coordinates of the following points:

A (..... , ...), B (..... , ...) and C (..... , ...)



b) Find the image of Δ ABC by translation (x + 2 , y + 3).

c) The length of $\overline{BC}$ = ... and the length of $\overline{AB}$ = ...

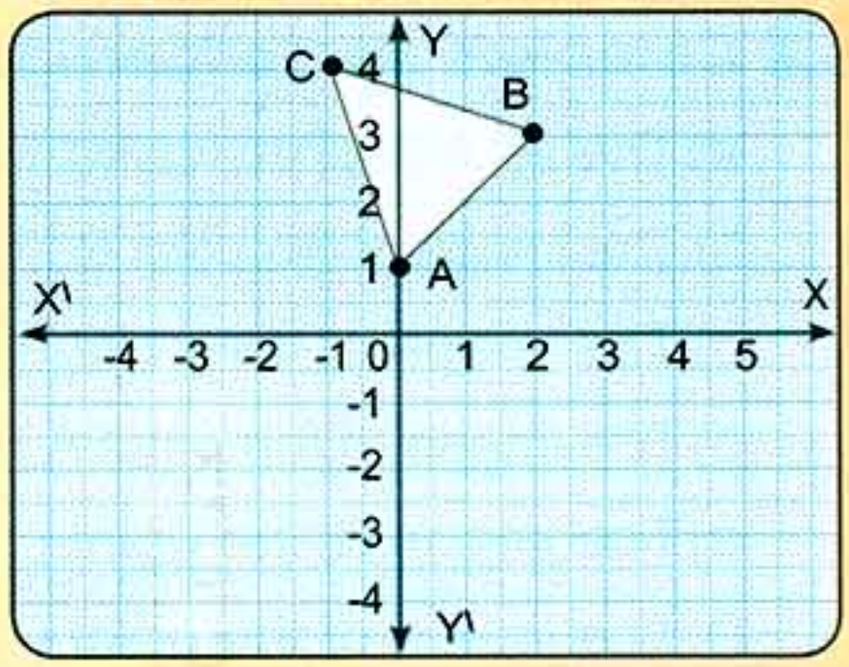
d) Is the triangle ABC symmetric or not? Why?

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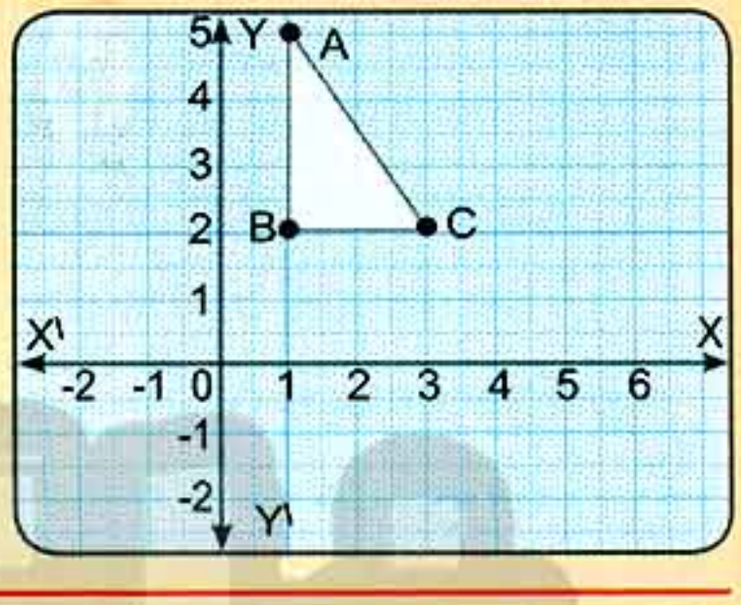
10 ***In the coordinate plane:***

find the image of triangle ABC by translation $(x - 2 , y - 3)$.



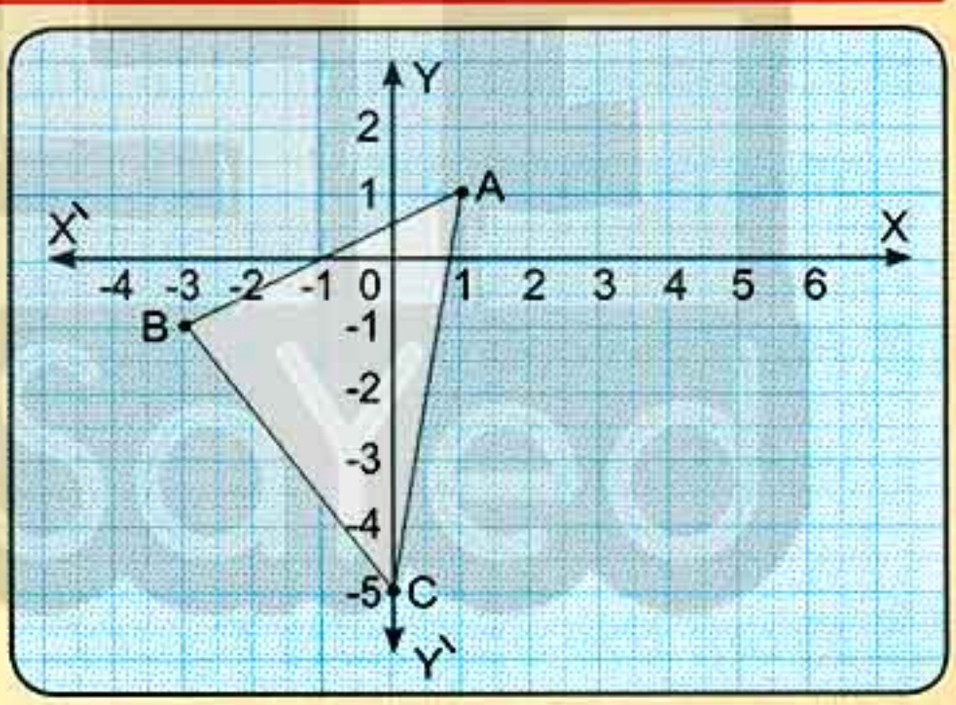
11 ***In the coordinate plane:***

determine the image of triangle ABC by translation $(x + 3 , y)$.



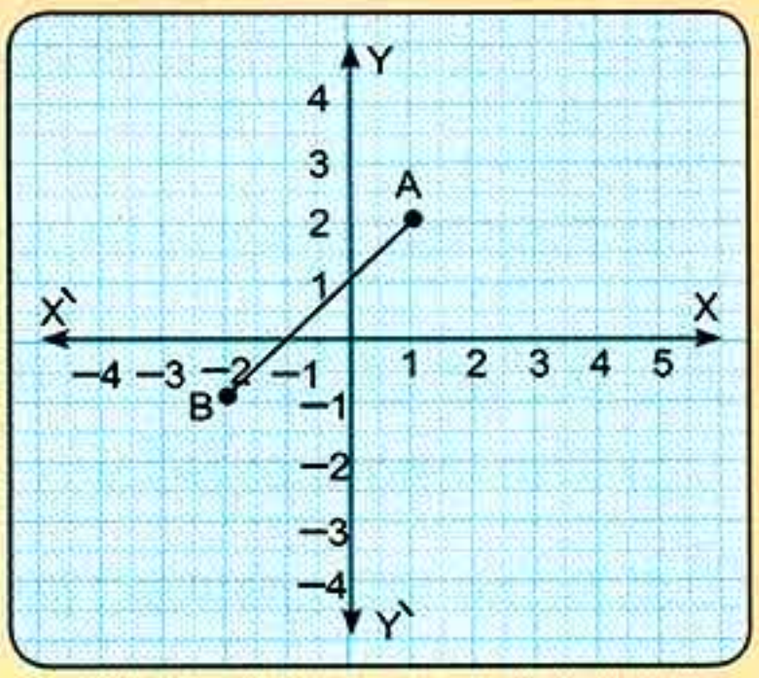
12 ***Draw on a square lattice:***

find the image by of triangle ABC by the (5 , 0) on the graph.



13 ***In the opposite figure:***

Find the image of the line segment $\overline{AB}$, where A (1 , 2) , B (– 2 , – 1) by translation $(x + 2 , y - 2)$.



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14 In the coordinate plane:

Draw the square LMNO, where L (6 , 0), M (6 , 6), N (0 , 6) and O (0 , 0), then find its image by translation $(x - 3 , y - 4)$.

15 ***In the coordinate plane:***

Draw the parallelogram ABCD, where A (–1 , 1), B (– 2 , 3), C (– 8 , 3) and D (– 7 , 1), then find its image by translation $(x + 4 , y - 2)$.

16 ***In the coordinate plane:***

Draw the rectangle ABCD, where A (–4 , – 3), B (–4 , 0), C (2 , 0) and D (2 , – 3), then find its image by translation $(x , y + 3)$.

17 ***Determine the following points on the coordinate plane:***

A (5 , 1), B (5 , 4), C (1 , 4) and D (1 , 1), then find:

a) The lengths of $\overline{AB}$, $\overline{CD}$, $\overline{AD}$ and $\overline{BC}$.

b) The perimeter of the shape ABCD. c) The area of the shape ABCD.

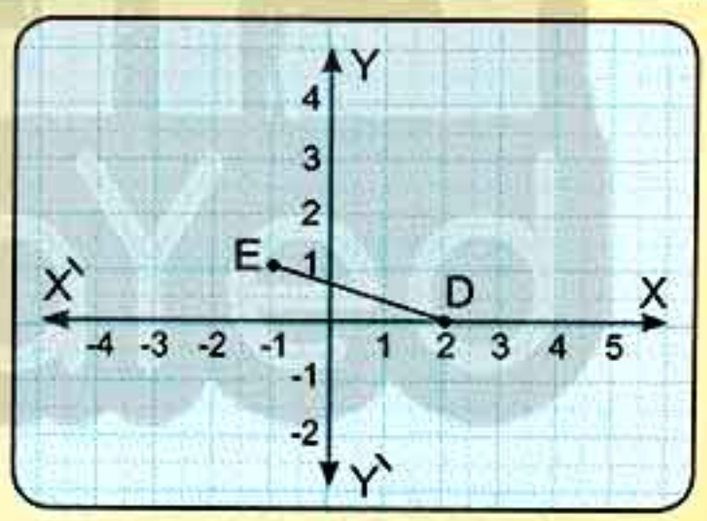
d) The image of the shape ABCD by translation (AD) in the direction of $\overrightarrow{AD}$.

18 🕮 ***In the opposite figure:***

Determine the image of $\overline{DE}$ where:

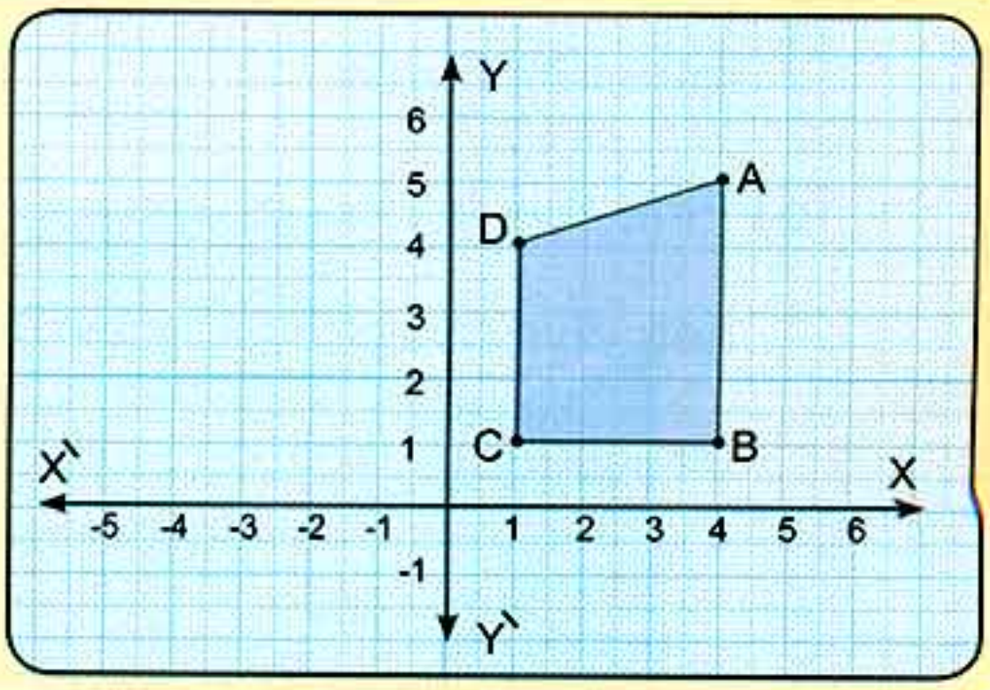
D (2 , 0), E (–1 , 1) by translation $(x + 3 , y + 2)$

What is the name of the shape DD`E`E? Why?



19 🕮 ***Using the coordinate plane, determine:***

The image of the quadrilateral ABCD by translation (3 , – 4).



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20 Determine the image of the shape:

ABCD where A (5 , 1), B (2 , 1), C (5 , 4) and D (2 , 4) by translation: two steps down, one step left and followed by two steps down.

21 📖 ***On a square lattice, find the image of the rectangle:***

ABCD in which A (4 , 1), B (4 , 3), C (1 , 3) and D (1 , 1)

by translation (x + 3 , y + 3).

22 ***Determine the points:***

A (– 3 , 4), B (1 , 4) and C (1 , 2) on the coordinate plane, then find:

a) AB = ..., BC = ...

b) The image of Δ ABC by translation (0 , – 3).

23 📖 a) If the image of the point (A , B) by the translation (2 , – 3) is (5 , – 4) find (A , B).

b) If the image of the point (x , y) by the translation (3 , – 2) is the point (– 4 , 5), find the coordinates of the point (x , y).

c) If the image of the point (4 , 5) is (2 , 5) by translation, then write the translation rule.

d) Find the image of the point (– 3 , 4) by the translation 4 units in the negative direction of y-axis, then by the translation 3 units in the positive direction of x-axis.

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Cumulative Exercise

24 ***Represent the points A (2 , 3), B (4 , – 2) , C (– 2 , – 2) , D (– 4 , 3), E (– 4 , – 2) on the coordinate plane, then find:***

a) The lengths of $\overline{AD}$, $\overline{DE}$, and $\overline{BC}$.

b) The area of the figure ABCD.

c) The area of the Δ DEC.

d) The image of the figure ABCD by the translation (2 , – 2).

25 ***If $\overline{A'B'}$ is the image of $\overline{AB}$ by translation (– 6 , 0) where A(4 , 5), B(4 , 2)***

Find the following:

1) The length of $\overline{AA'}$.

2) The length of $\overline{BB'}$.

3) The name of the figure $AA'B'B$ is it symmetric or not?

Think and Explore

26 If Δ XYZ is the image of Δ ABC by the translation (a + 1 , b – 1)

Find the value of a , b if X (–1 , 2) and A (3 , 0).

.....

.....

.....



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Lesson 3

THE AREA OF THE CIRCLE

Aims

At the end of this lesson, you will be able to:

(1) recognise the definition of the circular sector.

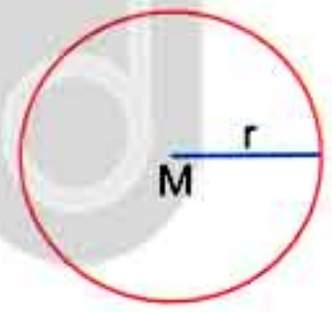
(2) calculate the surface area of the circle.

WARM UP

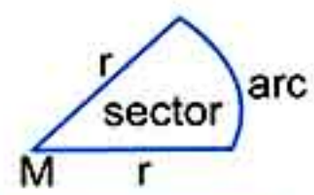
watch video

You have studied before that:

- The circumference of the circle M is:
 the length of the closed curve forming the circle = $2 \times \pi \times r$
 where "r" is its radius $\left(\pi \simeq \frac{22}{7} \text{ or } 3.14\right)$



- The area of any figure equals:
 the sum of areas of its all parts



- We can divide any surface area of a circle into equal circular sectors.

From that:

We will deduce a rule for calculating the area of any circle.



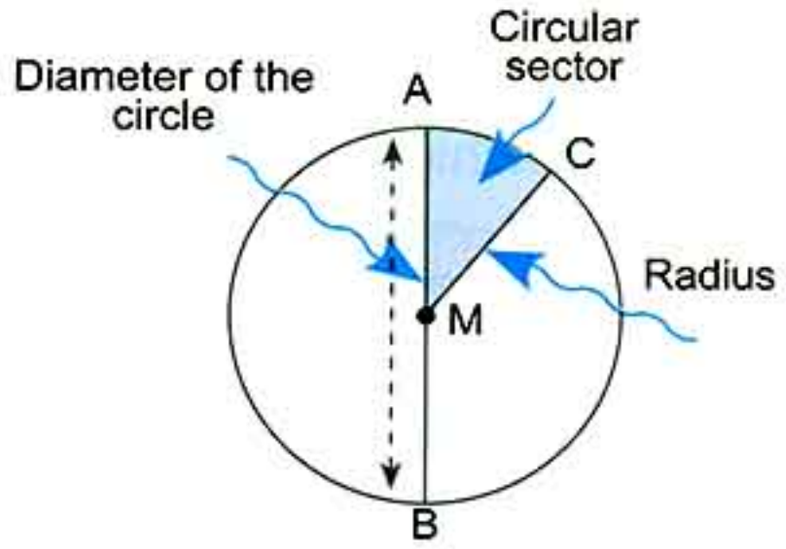
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Remember what you have studied befor in the last year

Definitions

1- A circle:

It is a closed curve where each point on this curve is equidistant from a fixed point, this fixed point is the centre of the circle and this constant distance is the radius.



In the opposite figure:

- M is the centre of the circle.
- $\overline{MC}$ is the radius of the circle

and $MC = r$

- $\overline{AB}$ is the diameter of the circle

and $AB = 2 \times r$

2 - The circumference of a circle:

It is the length of this closed curve

i.e. The circumference of the circle $= 2\pi r$,

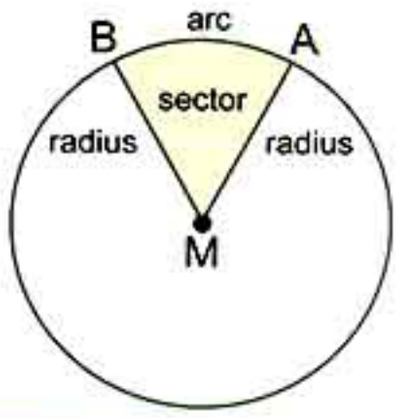
where r is the radius of the circle and $\pi \simeq \frac{22}{7}$ or 3.14

3 - The circular sector:

It is a part of the surface of the circle bound by two radii and an arc between them.

for example: in the opposite figure:

The shaded part AMB is called a circular sector.



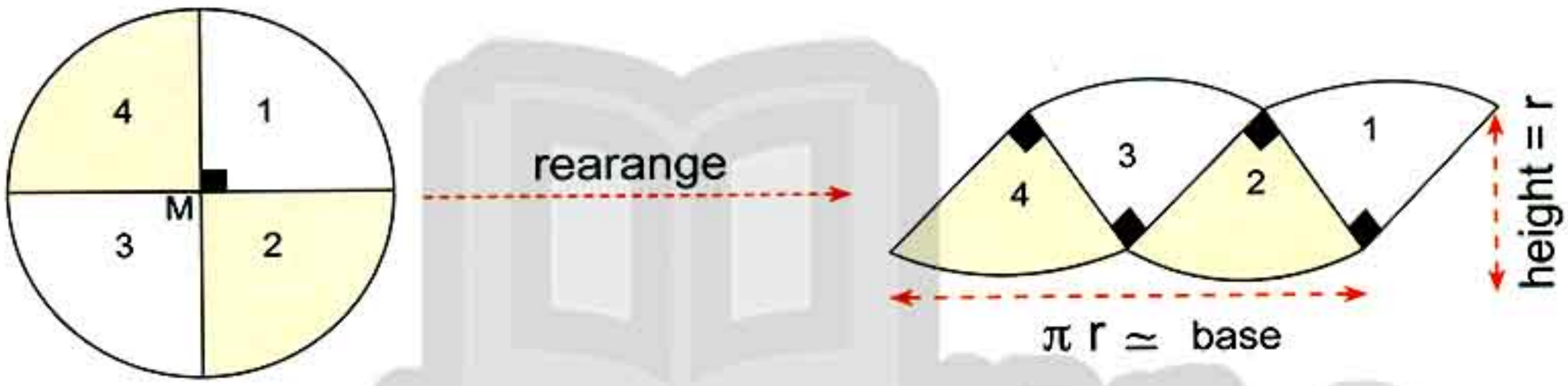
sector	قطاع	equidistant	على مسافة واحدة	arc	قوس

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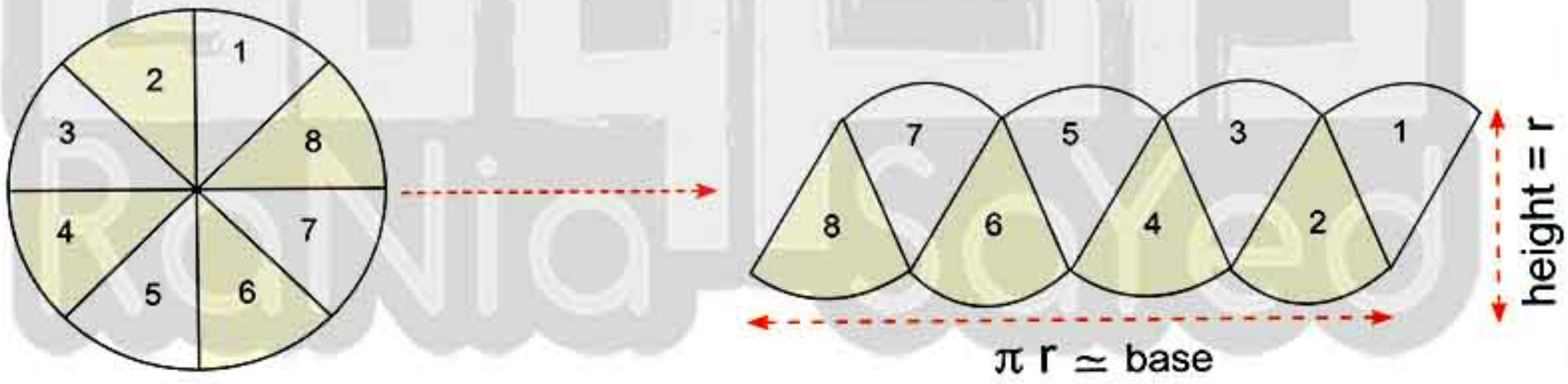
Finding the area of the circle:

Notice each of the following:

1) The two perpendicular diameters divide the surface area of the circle into 4 circular sectors equal in area then:
By cutting these circular sectors and rearranging them we can get a shape which is closer to be a parallelogram as follows:



2- Also if we divide the surface area of the circle into 8 equal circular sectors and then cutting and rearranging them one by one, we will get a shape which is more closer to a parallelogram.



3- If we continue repeating dividing the circle into more and more equal circular sectors at last the shape will be closer to be a parallelogram of base length "πr" and height "r".

Then, the surface area of the circle ≃ surface area of a parallelogram.

∵ the area of the parallelogram = base length x height

∴ The area of the circle = π r x r
= π r^2

rearrange إعادة الترتيب

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Solved Example 1

Find the area of the circle whose diameter length is 21 cm ($\pi \simeq \frac{22}{7}$).

Solution

$r = 21 \div 2 = 10.5$ cm

The area of the circle $= \pi r^2 = \frac{22}{7} \times (10.5)^2 = \frac{22}{7} \times 10.5 \times 10.5 = 346.5$ cm^2.

Check Point

Calculate the area of the circle whose diameter length is 16 cm ($\pi \simeq 3.14$).

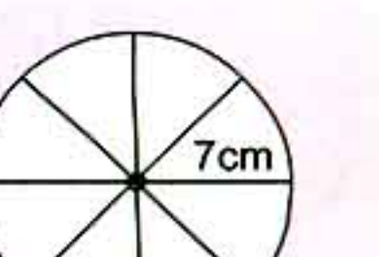
.....

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Solved Example 2

A circle whose diameter length equals 42 cm is divided into six equal circular sectors.

Find the area of each sector ($\pi \simeq \frac{22}{7}$)***:***



Solution

$r = 42 \div 2 = 21$ cm.

The area of the circle $= \pi r^2 = \frac{22}{7} \times (21)^2 = \frac{22}{7} \times 21 \times 21 = 1\,386$ cm^2.

The area of each sector $= 1\,386 \div 6 = 231$ cm^2.

Check Point

In the opposite figure, a circle M of a radius 7 cm is divided into eight equal circular sectors.

Calculate the area of one sector ($\pi \simeq \frac{22}{7}$).

.....

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Solved Example 3

If the area of a circle is 154 cm², then find its radius length ($\pi \simeq \frac{22}{7}$).

Solution

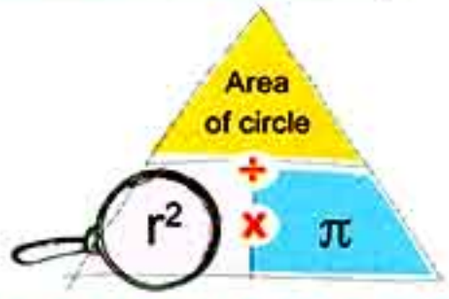
$\because$ the area of the circle = πr^2,

$\therefore r^2 = \text{area} \div \pi \simeq 154 \div \frac{22}{7}$

$\simeq 154 \times \frac{7}{22} \simeq 49 \text{ cm}^2$

$\because 49 = 7 \times 7, \therefore r \simeq 7 \text{ cm}$

Remember that



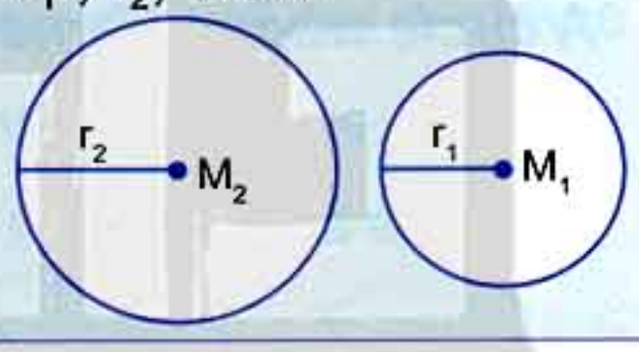
Check Point

If the surface area of a circle is 616 cm², ***find its radius length.***

IMPORTANT REMARKS

In the opposite figure: if M_1, M_2 are two circles of radii r_1 , r_2, then:

1. $\frac{\text{circumference of circle } M_1}{\text{circumference of circle } M_2} = \frac{2\pi r_1}{2\pi r_2} = \frac{r_1}{r_2}$
2. $\frac{\text{area of circle } M_1}{\text{area of circle } M_2} = \frac{\pi r^2}{\pi r^2} = \frac{(r_1)^2}{(r_2)^2}$



Solved Example 4

If the circumference of a circle equals 125.6 cm, then find its area ($\pi \simeq 3.14$):

Solution

$\because$ the circumference of the circle = $2\pi r$

$\therefore r$ = circumference ÷ (2π)

= $125.6 \div (2 \times 3.14) \simeq 20$ cm,

$\therefore$ the area of the circle = πr^2

= $3.14 \times (20)^2 \simeq 1\,256 \text{ cm}^2$.

Remember that



Check Point

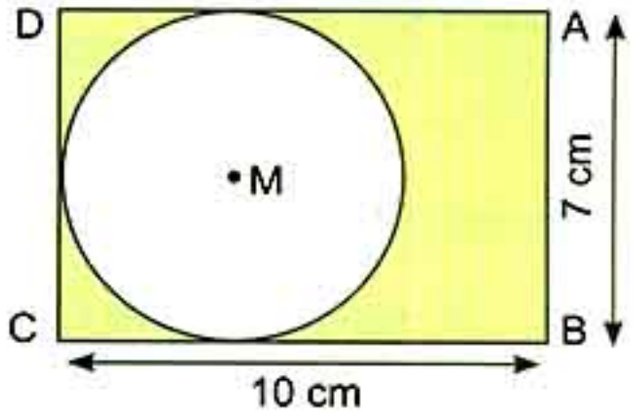
A circle, its circumference is 57 cm. ***Calculate its area.*** ($\pi \simeq \frac{22}{7}$)

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Solved Example 5

In the opposite figure:
ABCD is a rectangle whose dimensions are 10 cm and 7 cm, find the area of the shaded part $\left(\pi \simeq \frac{22}{7}\right)$.



Solution

∵ The area of the rectangle = length x width

$= 10 \times 7 = 70 \text{ cm}^2$.

∵ The area of the circle = πr^2 (where $r = \frac{7}{2} = 3.5$)

$= \frac{22}{7} \times (3.5)^2 = 38.5 \text{ cm}^2$.

∴ the area of the shaded part = the area of the rectangle – the area of the circle

$= 70 - 38.5 = 31.5 \text{ cm}^2$.

Note that

The length of $\overline{CD}$ equals the diameter of the circle M because the circle touches both sides $\overline{AD}$ and $\overline{BC}$.

Check Point

In the opposite figure, M is a circle of radius 5 cm, a rectangle is drawn inside it, its length is 8 cm and width is 6 cm. ***Calculate the area of the shaded part*** $(\pi \simeq \frac{22}{7})$.



.....

.....

Information from UNICEF

I brush my teeth with a toothpaste and toothbrush after meals and before going to bed.



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EXERCISE 3 The area of the circle

1 Complete:

a) The surface area of the circle = ...

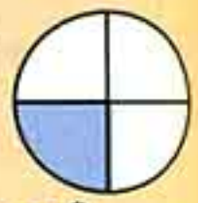
b) A circle of radius 7 cm, its surface area = ...

c) The length of the radius of the circle whose area is 616 cm² ($\pi \simeq \frac{22}{7}$) = ... cm.

d) A circle whose radius is 14 cm, then half of its surface area = ... cm² ($\pi \simeq \frac{22}{7}$) *(Ismailia 2017)*

e) A circle, whose diameter length is 14 cm, then its surface area = ... cm². ($\pi \simeq \frac{22}{7}$) *(South Sinai 2015)*

f) The area of the sector which represents $\frac{1}{4}$ of the surface of a circle whose radius is 7 cm = ... cm². ($\pi \simeq \frac{22}{7}$)



g) The area of the circle whose circumference is 20 π cm = ... cm².

h) The area of a circle with radius 1 cm = ... cm².

2 Choose the correct answer:

a) The area of the surface of a circle = ... (π r *or* π r² *or* 2 π r *or* 2 π r²)

b) The area of the circular sector that represents $\frac{1}{2}$ the surface of a circle = ...
($\frac{1}{2}$ π r² *or* $\frac{1}{2}$ π r *or* π r *or* π r²)

c) The surface area of a circle with diameter length 8 cm = ... π cm² .
(4 *or* 8 *or* 16 *or* 64)

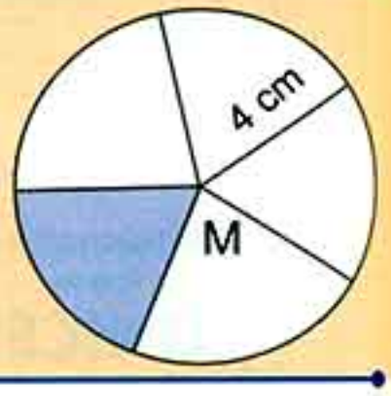
d) $\frac{1}{2}$ the diameter of a circle = ... (2 r *or* r² *or* 2 r² *or* r)

e) The circumference of a circle = ... (2 π r² *or* 2 π r *or* π r *or* $\frac{1}{2}$ π r²)

3 The circle, whose diameter is 12 cm, calculate its surface area where ($\pi \simeq \frac{22}{7}$).

4 ***In the opposite figure:***

M is a circle of radius length 4 cm, is divided into five equal circular sectors. Calculate the surface area of each sector where ($\pi \simeq 3.14$).



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5 If the surface area of a circle is 314 cm², calculate its circumference ($\pi \simeq 3.14$).

6 If the surface area of a circle is 154 cm², calculate its circumference ($\pi \simeq \frac{22}{7}$).

7 If the circumference of a circle is 88 cm, calculate its radius length and its surface area given that ($\pi \simeq \frac{22}{7}$). *(Cairo 2019)*

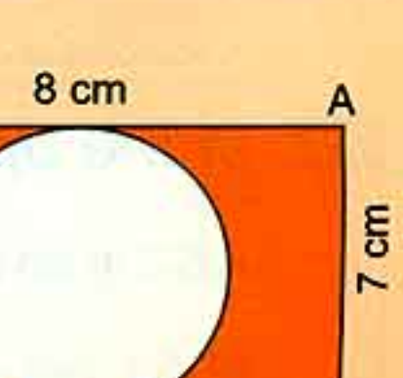
8 If the circumference of a circle is 31.4 cm, calculate its surface area ($\pi \simeq 3.14$).

9 If the circumference of a circle is 62.8 cm, calculate its area ($\pi \simeq 3.14$).

10 If the circumference of a circle is 44 cm, calculate its radius length and its area. ($\pi \simeq \frac{22}{7}$)

11 ***In the opposite figure:***

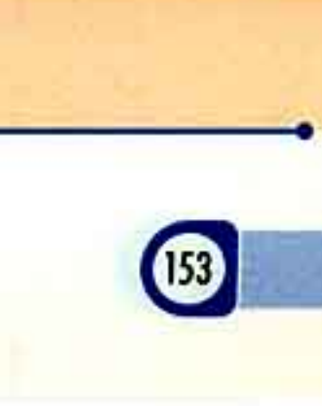
M is a circle if half of its surface area is 100.48 cm², then calculate its circumference, where ($\pi \simeq 3.14$).



12 ***In the opposite figure:***

M is a circle drawn inside a square of side length 14 cm, where the circle touches its sides.

Calculate the area of the shaded part ($\pi \simeq \frac{22}{7}$). *(Kafr El Sheikh 2017)*



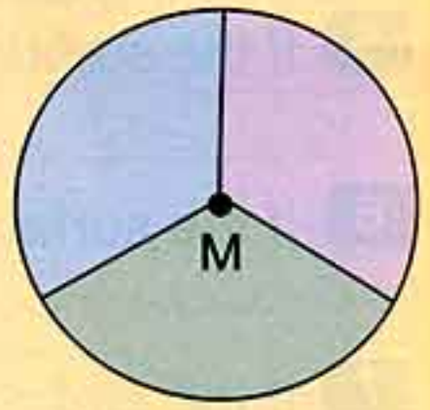
13 ***In the opposite figure:***

ABCD is a rectangle whose length is 8 cm and width is 7 cm and a circle is drawn touching the sides $\overline{AD}$, $\overline{BC}$. Calculate the area of the shaded part ($\pi \simeq \frac{22}{7}$). *(Giza 2019)*

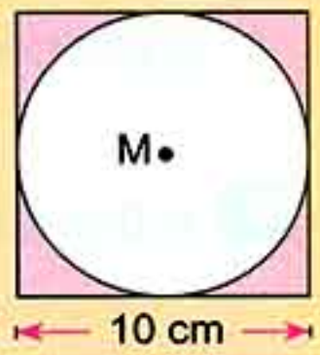
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14 🕮 ***In the opposite figure:***

The circle M is divided into three equal circular sectors: if the surface area of one sector is 37.68 cm^2, then find its radius length ($\pi \simeq 3.14$).

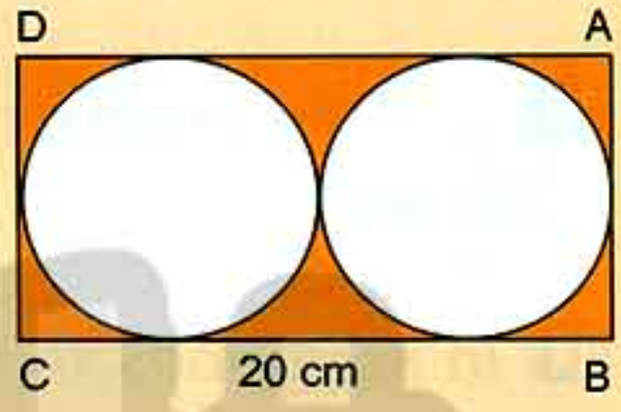


15 🕮 ***M is a circle drawn inside a square of side length 10 cm. Find the area of the shaded part*** ($\pi \simeq 3.14$).



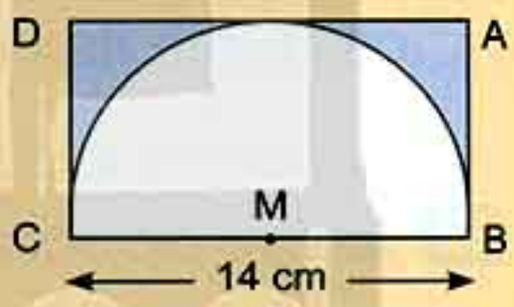
16 ***In the opposite figure:***

If ABCD is a rectangle whose length is 20 cm and width equals half its length, calculate the area of the shaded part ($\pi \simeq 3.14$ or $\frac{22}{7}$).



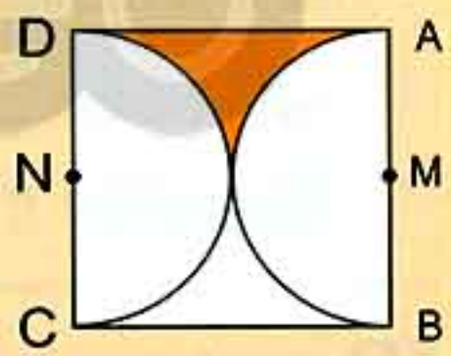
17 ***In the opposite figure:***

If ABCD is a rectangle whose length is 14 cm, calculate the area of the shaded part ($\pi \simeq \frac{22}{7}$).



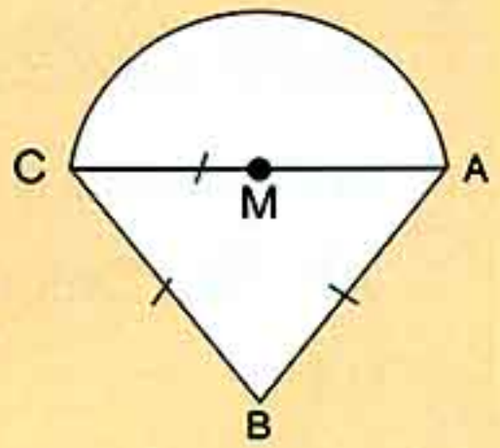
18 ***In the opposite figure:***

ABCD is a square of side length 7 cm, calculate the area of the shaded part ($\pi \simeq \frac{22}{7}$).



19 ***In the opposite figure:***

ABC is an equilateral triangle, which has a perimeter of 21 cm. If a semicircle of centre M is drawn on $\overline{AC}$, find the area of the semicircle ($\pi \simeq \frac{22}{7}$).



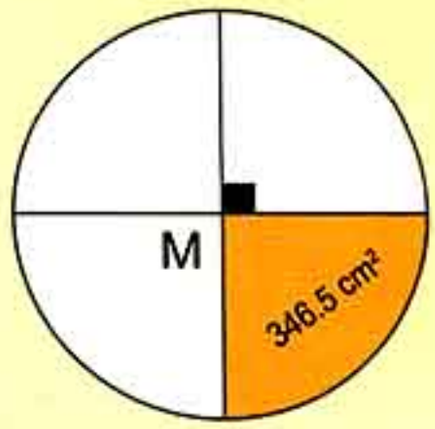
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20 ***In the opposite figure:***

A circle M is divided into four equal circular sectors. If the surface area of each sector is 346.5 cm². Calculate:

a) The length of the radius of the circle ($\pi \simeq \frac{22}{7}$).

b) The circumference of the circle.



21 A circular birthday torte of diameter length 25 cm is divided into eight equal circular sectors. Then find the surface area of each sector approximating the result to the nearest integer ($\pi \simeq 3.14$).

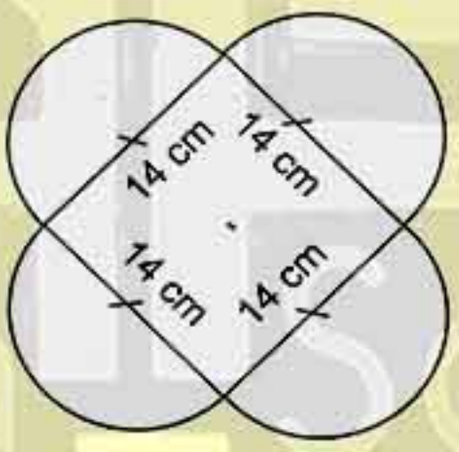


22 ***Find the area of the following shapes*** ($\pi \simeq \frac{22}{7}$).

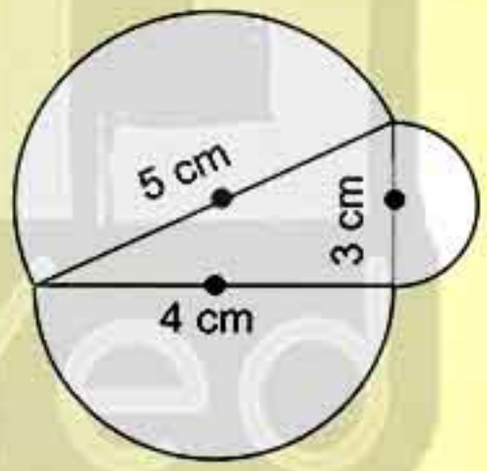
a)



b)

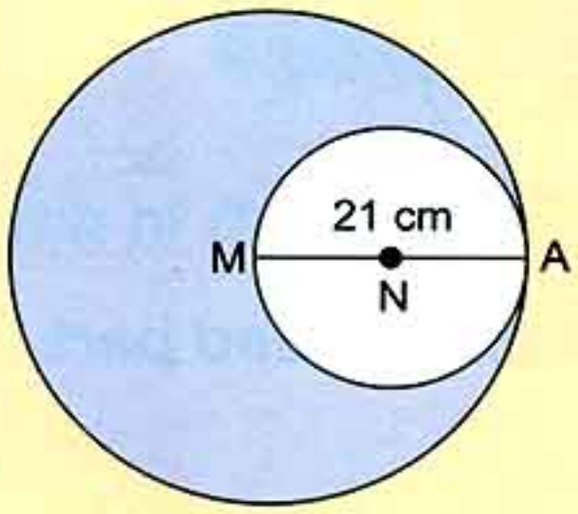


c)

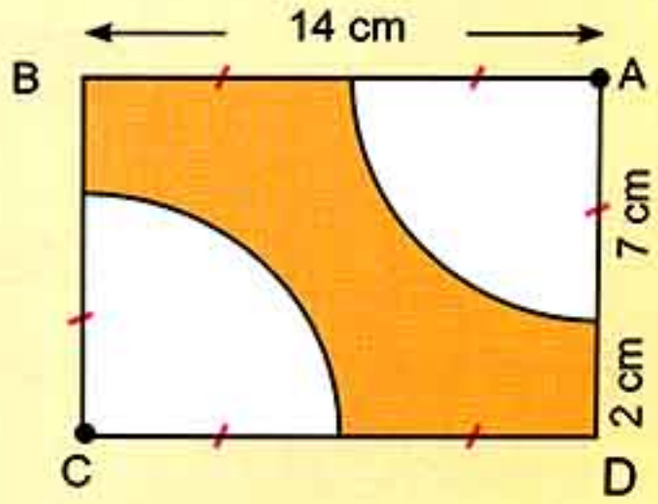


23 ***Find the area of the shaded part in each shape of the following:***

a)



b)

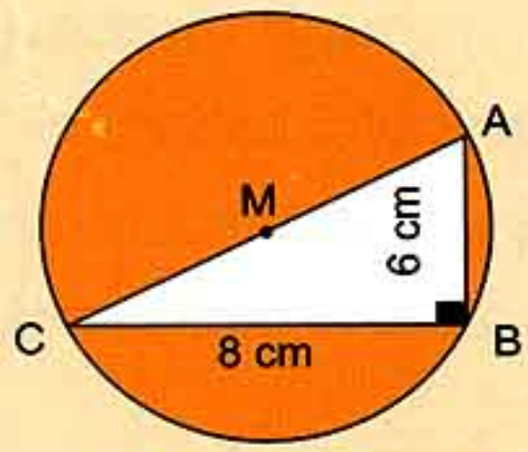


torte تورتة

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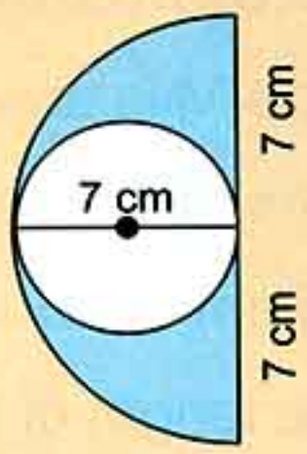
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c)



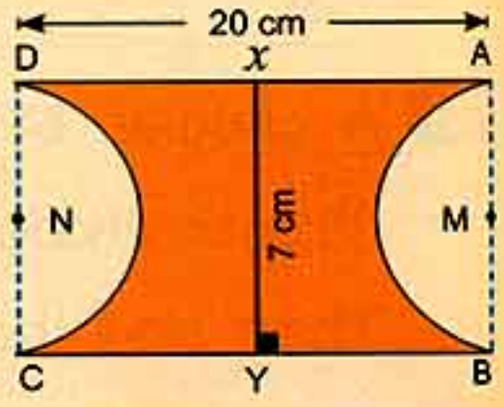
where the diameter = 10 cm

d)



24 ***In the opposite figure:***

Find the area of the shaded part where M and N are two half circles, AD = 20 cm and XY = 7 cm ($\pi \simeq \frac{22}{7}$).

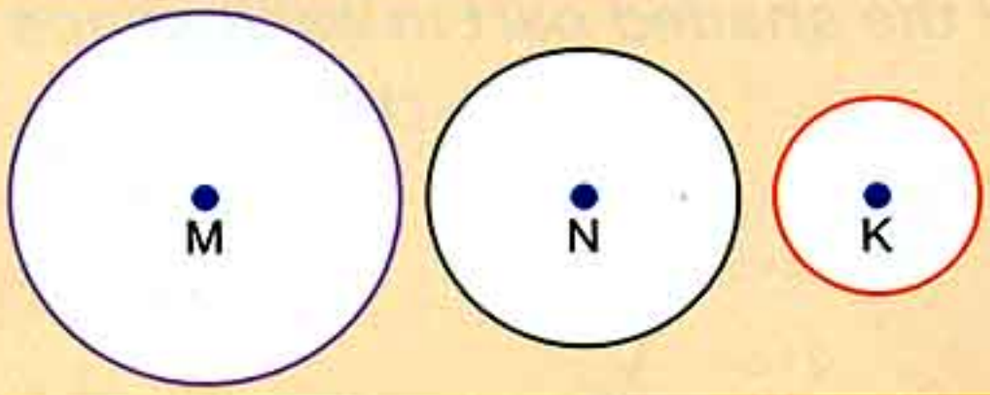


25 A table, its surface in the form of a circle with diameter 1.5 m, we want to cover its surface by a sheet of glass. Calculate the cost price if the square metre of this glass costs L.E. 60.
($\pi \simeq \frac{22}{7}$ or 3.14)

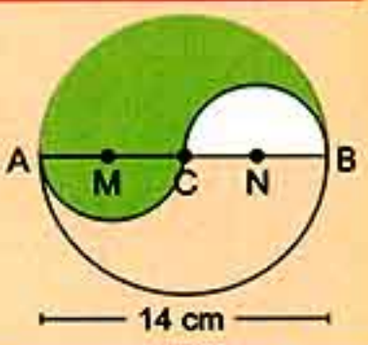


26 A carpet in the shape of a circle with diameter length 200 cm, calculate the price of the carpet given that the price of each square metre is L.E. 50. ($\pi \simeq 3.14$)

27 If the ratio between the circumferences of three circles is 1: 2: 3, find the ratio between the areas of these circles.



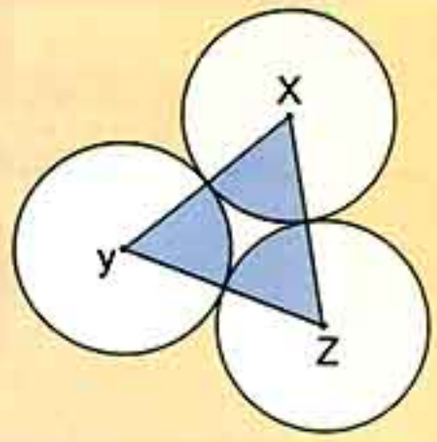
28 ***Find the perimeter and the area of the shaded part.***



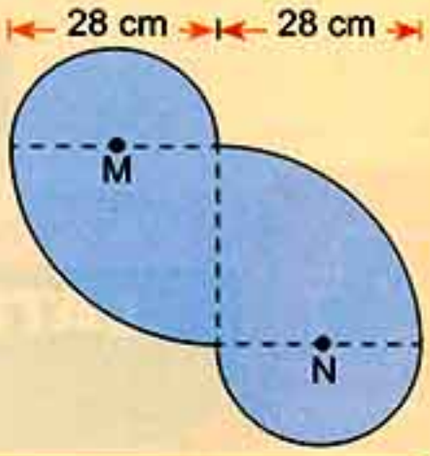
carpet	سجادة	table	ملضدة	sheet of glass	لوح من زجاج		

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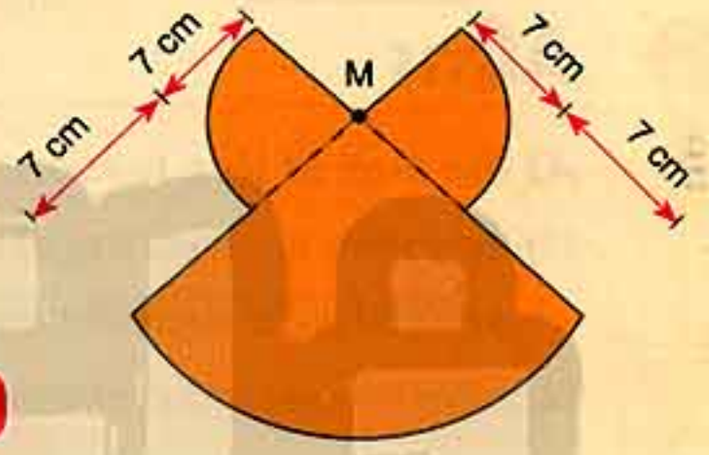
29 The opposite figure represents three congruent circles, the radius of each is 10 cm. If $\frac{1}{6}$ of each circle is shaded, find the total area of the shaded part part where $\pi \simeq 3.14$.



30 The opposite figure represents two halves of a circle and two quarters of another circle.
Find the area and the perimeter of the figure. $(\pi \simeq \frac{22}{7})$



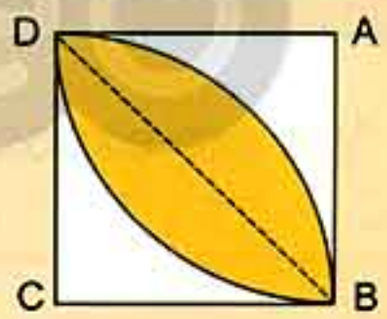
31 The opposite figure represents three quarters of different circle.
Find the area of the shaded figure. $(\pi \simeq \frac{22}{7})$



Cumulative Exercise

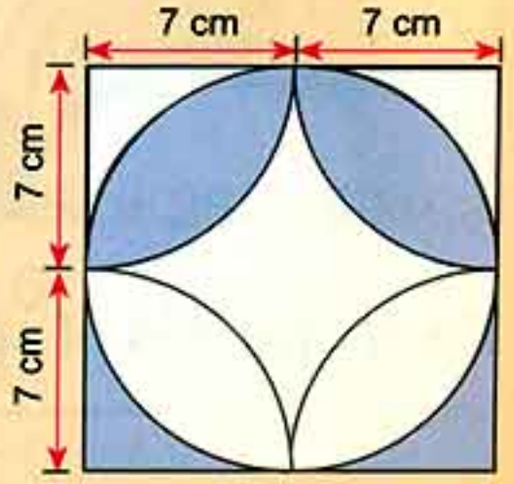
32 A circle whose area equals the area of a rhombus whose diagonal lengths are 44 cm and 28 cm. Find the length of the radius of the circle and its circumference. $(\pi \simeq \frac{22}{7})$

33 In the opposite figure: ABCD is a square of side length 7 cm, find the perimeter and the area of the shaded part.



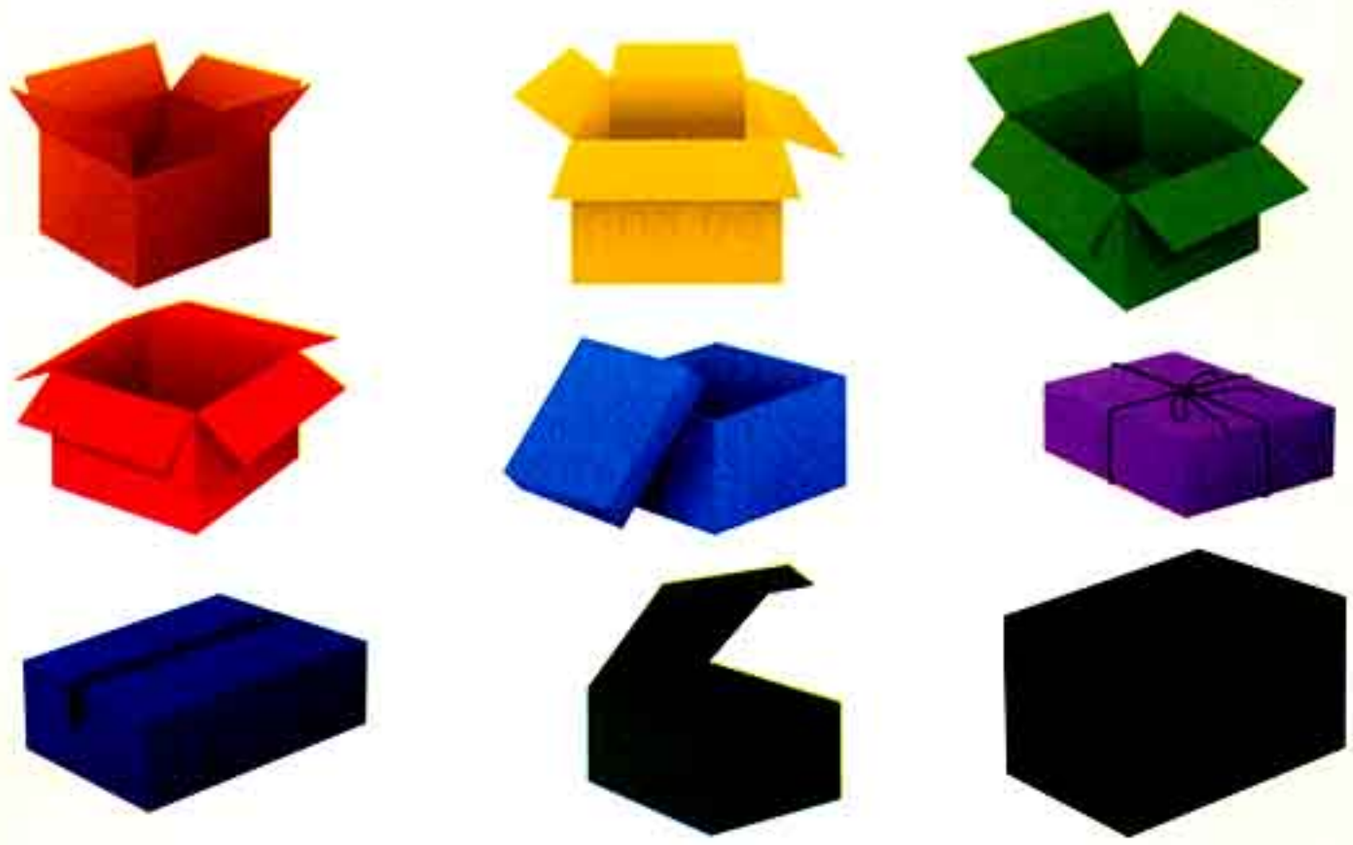
Think and Explore

34 ***Find the area of the shaded part: where*** $(\pi \simeq \frac{22}{7})$



congruent متطابقة

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Lesson 4

LATERAL SURFACE AREA AND TOTAL SURFACE AREA OF A CUBE AND A CUBOID

Aims

At the end of this lesson, you will be able to:

(1) recoginse the meaning of the lateral surface area and the total surface area of a cube and a cuboid and calculate each of them.

(2) solve miscellaneous exercises related to lateral surface area and total surface area of a cube and a cuboid.

WARM UP

watch video

We are exposed daily to objects like a wooden box, a matchbox, a dice, etc.







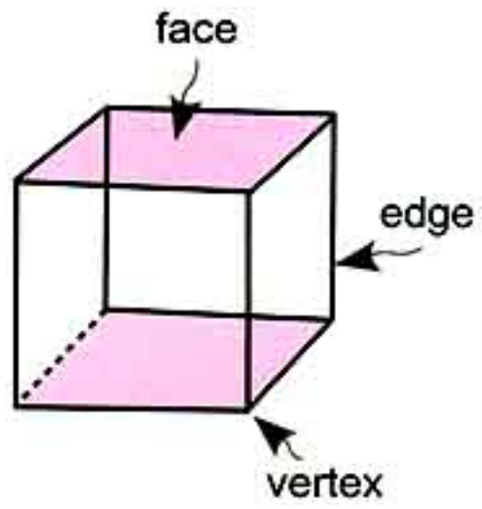
Each object is of six faces represents a cube or a cuboid.

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First The lateral area and the total area of the cube

Prelude:

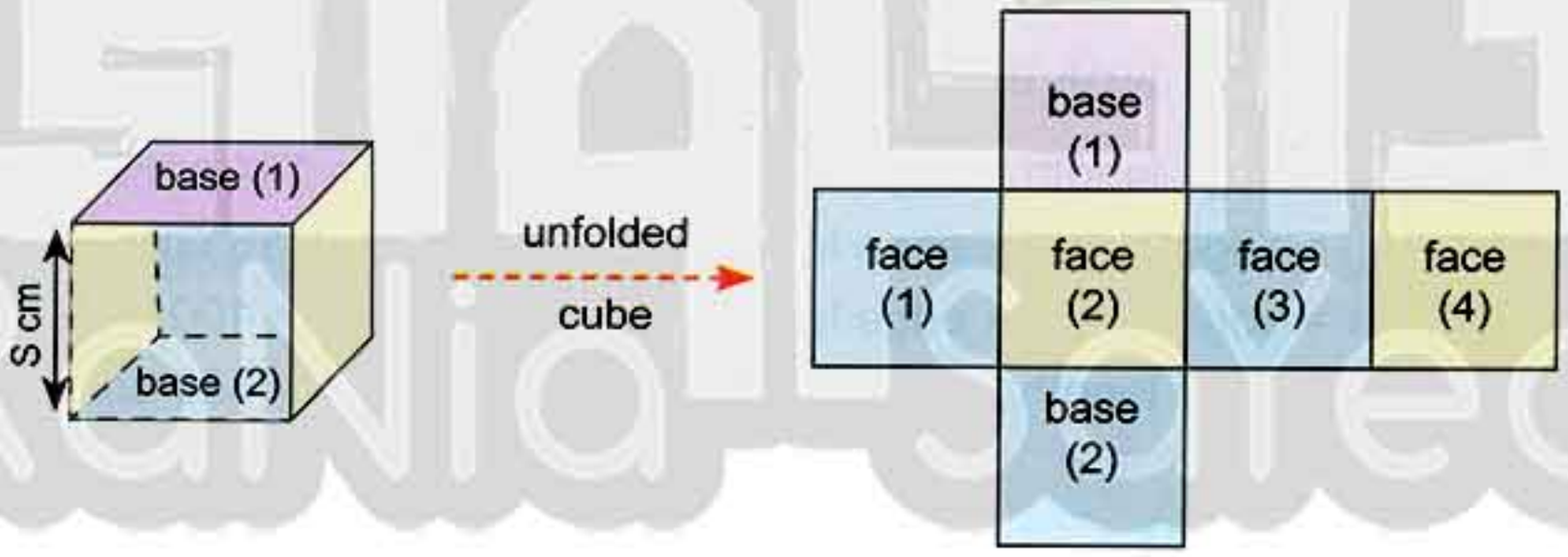
- The cube has 6 faces, each face is a square and these squares are equal in area.
- The area of the square = side length × itself = S × S
 and the perimeter of the square = side length × 4 = S × 4
- The cube has 12 edges and these edges are equal in length.
- The cube has 8 vertices.



The volume of the cube = edge length × itself × itself.

Notice that:

The following figure represents a cube of edge length "S" cm and its faces are flattened.



1- The lateral area of the cube, with edge length S

= area of (face (1) + face (2) + face (3) + face (4))

= area of one face x 4

= S x S x 4 = 4 S^2 = edge length x itself x 4.

2- The total area of the cube with edge length "S":

= the lateral area of the cube + the area of its two bases = $4S^2 + 2S^2 = 6S^2$

i.e. The total area of the cube = the area of one face x 6

= edge length x itself x 6

lateral area المساحة الجانبية

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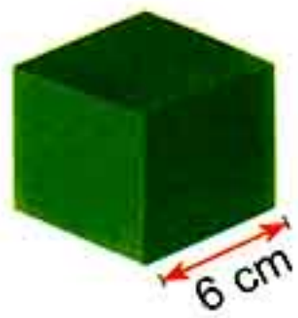
Note that

1. If the cube is without a lid, then the total area
 = the area of one face × 5 = S^2 x 5 = edge length x itself x 5.
2. We consider any cube with a lid unless otherwise is mentioned.

Solved Example 1

Calculate the lateral area and the total area for each of the following cubes:

(a) If its edge length equals 6 cm.



(b) If its edge length equals
10 cm and is without a lid.



Solution

(a) The lateral area = edge length x edge length x 4 = 6 x 6 x 4 = 144 cm².
The total area = edge length x edge length x 6 = 6 x 6 x 6 = 216 cm².

(b) The lateral area = edge length x edge length x 4 = 10 x 10 x 4 = 400 cm².
The total area = edge length x edge length x 5 = 10 x 10 x 5 = 500 cm².

Note that

Area of one face of the cube = its lateral area ÷ 4

Area of one face of the cube with a lid = its total area ÷ 6

Area of one face of the cube without a lid = its total area ÷ 5

Check Point

Find the lateral and total surface area of a cube of edge length 8 cm.

.....

edge length طول الحرف | lid غطاء

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Solved Example 2

If the lateral area of a cube is 36 cm², find the area of one face and its total area.

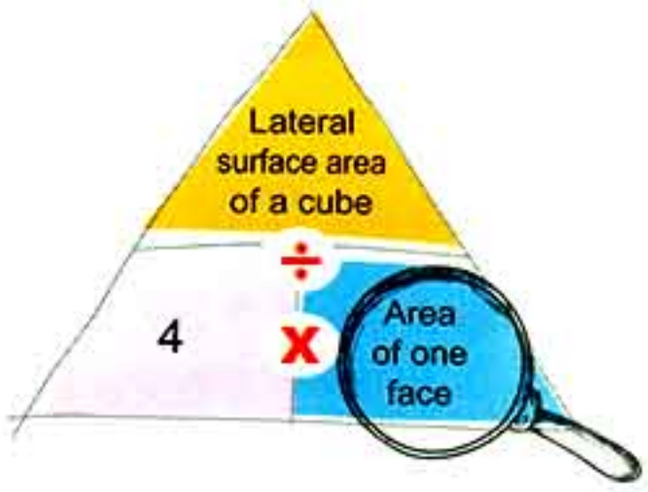
Solution

The area of one face = lateral area of a cube ÷ 4

= 36 ÷ 4 = 9 cm².

Total area of a cube = area of one face x 6

= 9 x 6 = 54 cm².



Check Point

If the total area of a cube is 54 cm², ***calculate its lateral surface area.***

.....

Solved Example 3

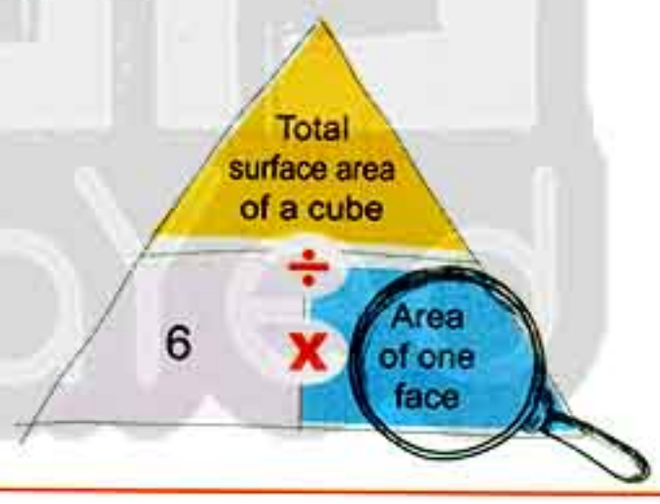
The total area of a cube is 600 cm², find the lateral area.

Solution

The area of one face = the total area ÷ 6

= 600 ÷ 6 = 100 cm².

Then the lateral area of the cube = 100 × 4 = 400 cm².



Check Point

If the total area of a cube is 54 cm², ***calculate its lateral surface area.***

.....

Note that

$$\frac{\text{Lateral area of a cube}}{\text{Total area of a cube}} = \frac{4 \times S \times S}{6 \times S \times S} = 2 : 3$$

i.e. The ratio between the lateral area of a cube and its total area = 2 : 3.

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Solved Example 4

If the perimeter of one face of a cube is 32, find:

(a) Its lateral area. (b) Its total area. (c) Its volume.

Solution

Edge length of the cube = the perimeter of one of its faces ÷ 4 = 32 ÷ 4 = 8 cm.

(a) Its lateral area = S x S × 4
= 8 x 8 × 4 = 256 cm^2.

(b) Its total area = 8 x 8 × 6 = 384 cm^2.

(c) Its volume = edge length x itself × itself
= S × S × S = 8 x 8 × 8 = 512 cm^3.

Check Point

If the perimeter of base of a cube is 28 cm, ***calculate its lateral and total area.***

.....

.....

Solved Example 5

If the total sum of edges of a cube = 60 cm, find:

(a) The area of one of its faces. (b) Its lateral area. (c) Its total area.

Solution

The length of one edge of the cube = sum of its edges ÷ 12 = 60 ÷ 12 = 5 cm.

(a) The area of one face of it = S × S = 5 × 5 = 25 cm^2.

(b) Its lateral area = the area of one face × 4 = 25 × 4 = 100 cm^2.

(c) Its total area = the area of one face × 6 = 25 × 6 = 150 cm^2.

Check Point

If the sum of the length edges of a cube is 132 cm, ***find its:***

1) lateral area 2) total area 3) area of one face

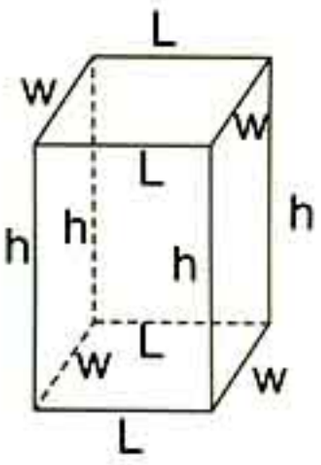
.....

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Second The lateral area and the total surface area of a cuboid:

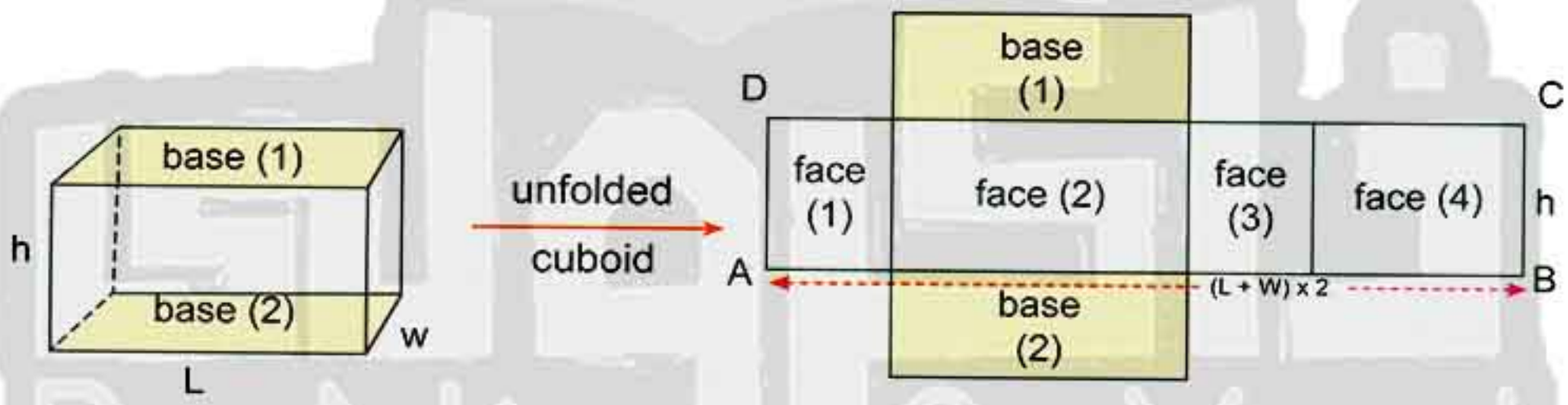
Prelude:



- The cuboid has 6 faces, each face is a rectangle and each two opposite rectangles are congruent.
- The cuboid is a 3-dimensional shape that has length, width and height (L, W, h). (if the 3 dimensions are equal then it is a cube)
- The cuboid has 12 edges four equal lengths, four equal widths and four equal heights
- The volume of cuboid = length x width x height = L × W × h.

Notice that:

The following figure represents a cuboid and its faces are flattened:



1-The lateral area of the cuboid with dimensions L , W and h

= area of face (1) + area of face (2) + area of face (3) + area of face (4)

= area of the rectangle ABCD = AB x BC

∴ The lateral area of cuboid

= perimeter of base x height = (L + W) x 2 x h

2-The total area of a cuboid with dimensions L , W and h

= its lateral area + the sum of areas of its two bases.

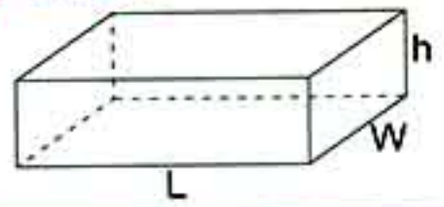
= (L + W) x 2 x h + 2 x L x W

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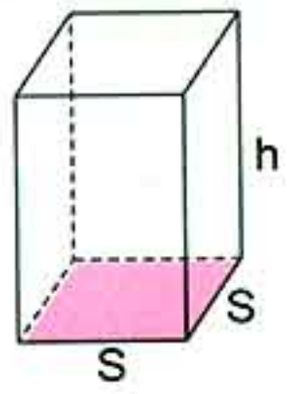
Note that

a) If the base of the cuboid is in the shape of a rectangle, then:



- The lateral area = (L + W) x 2 x h.
- The area of the two bases = L × W x 2.
- The total area = the lateral area + the sum of areas of the two bases
 = (L + W) × 2 × h + (L × W × 2).

b) If the base of the cuboid is in the shape of a square of side length S, then:



- The lateral area = perimeter of the base x height
 = S × 4 × h,
- The area of the two bases = S × S × 2.
- The total area = the lateral area + the sum of areas of the two bases
 = (S × 4 × h) + (S × S × 2).
- If this cuboid without a lid, then:
 The total area = the lateral area + the area of one base
 = (S × 4 × h) + (S × S).

We consider the cuboid with a lid unless is mentioned otherwise.

Solved Example 6

If the length of a cuboid is 9 cm, its width is 6 cm and its height is 10 cm, find:

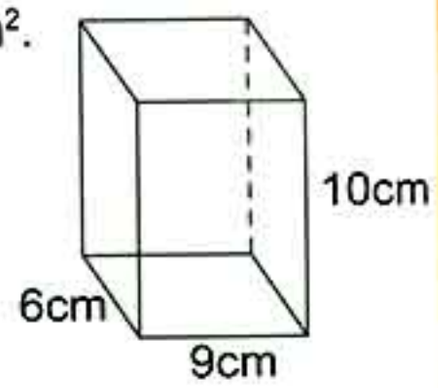
(a) Lateral area (b) Total area

Solution

(a) The lateral area of the cuboid = 2 (L + W) x h
= 2 (9 + 6) x 10 = 2 x 15 x 10 = 300 cm².

(b) ∵ The area of the two bases = 2 x L × W
= 2 x 9 × 6 = 108 cm².

∴ The total area of the cuboid = the lateral area + the area of two bases
= 300 + 108 = 408 cm².

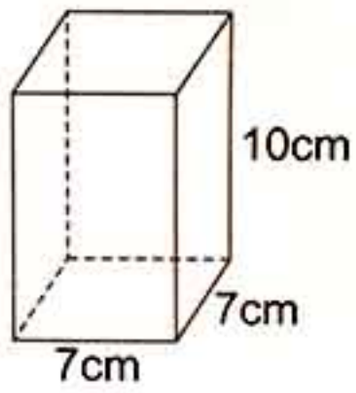


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Check Point

A cuboid with a square base of side length 7 cm and height 10 cm.

Find its lateral and total area.



A tip: Lateral area = 2 (7 + 7) × 10 = ...

, Total area = 2 (7 + 7) × 10 + 2 × 7 × 7 = ... complete.

Solved Example 7

A room with length 10 m and width 8 m and height 3.2 m, we want to paint its walls and ceiling. If the cost price of painting one square metre is 20 pounds, calculate the total cost of painting knowing that the room has two windows and a door of area 5.2 m².



Solution

The lateral area of the room = (L + W) x 2 × h = (10 + 8) × 2 × 3.2 = 115.2 m²

The lateral surface area – the area of 2 windows and a door. = 115.2 – 5.2 = 110 m².

The area of the ceiling = L × W = 10 x 8 = 80 m².

The total area that requires to be painted = 110 + 80 = 190 m².

The total cost price of painting = 190 × 20 = 3800 pounds.

Check Point

A room has a square floor of side length 5m and height 4m, we want to paint its walls and ceiling. If the cost price of painting one square meter is 30 pounds.

Calculate the total cost price of painting (knowing that the room has a door and a window of area 0.8 m²).

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Solved Example 8

Khaled used a piece of cardboard paper in the shape of a square with side length of 1.5 m to design a box in the shape of a cube with side length of 60 cm, calculate the area of the remaining paper.

Solution

The area of the piece of paper = side length x itself
= 1.5 × 1.5 = 2.25 m²
= 2.25 × 10 000 = 22 500 cm².

The total area of the box = side length x side length x 6
= 60 × 60 × 6 = 21 600 cm².

The remaining area of the paper = 22 500 – 21 600 = 900 cm².

Note that

1 m² —(x 100)→ 1dm² —(x 100)→ 1cm²
(x 10 000)

Solved Example 9

The inner dimensions of a truck box in the form of a cuboid without a lid are 6 m, 3.5 m and 1.8 m. We want to paint its inner floor and its inner faces knowing that the cost price of painting one square m is L.E. 20. Calculate the cost price of painting.



Solution

The lateral area of the truck box = (6 + 3.5) x 2 x 1.8 = 34.2 m².

The area of the floor of the truck box = 6 x 3.5 = 21 m².

∵ the box truck is without a lid,

∴ the area wanted to be painted = 34.2 + 21 m² = 55.2 m².

∴ the cost price of painting = 55.2 x 20 = L.E. 1104.

Check Point

A water tank in the form of a cuboid, its inner length is 1.5 m, width is 0.9 m and height is 2 m. It's wanted to be painted to prevent it from rust. If the cost price of one square metre of paint is L.E 15, ***calculate the cost price of painting.***

A tip: the area wanted to be painted is the total area of the cuboid

cardboard كرتون مقوى | remaining الباقى | design يصمم

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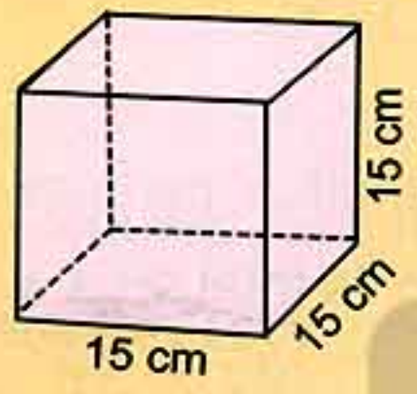
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EXERCISE 4 Lateral surface area and total surface area of a cube and a cuboid

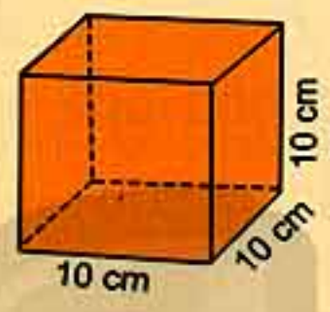
First The cube:

1 ***Calculate the lateral and total area of each of the following cubes:***

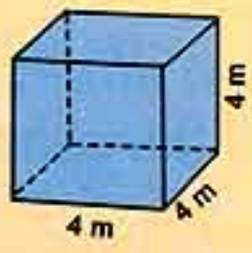
a) 📖



b)



c)



2 ***Complete each of the following:***

a) The lateral area of a cube of edge length 8 cm = ... cm^2.

b) 📖 The lateral area of a cube of edge length 6 cm = ... cm^2.

c) If the edge length of a cube is 4 cm, then its total area = ... cm^2.

d) 📖 If the sum of edge lengths of a cube is 84 cm, then its total area = ... cm^2.

e) 📖 If the area of base of a cube = 49 cm^2, then its lateral area = ... cm^2.

f) 📖 If the perimeter of base of a cube = 24 cm, then its total area = ... cm^2.

g) 📖 If the volume of a cube is 1000 cm^3, then its total area = ... cm^2.

h) If the area of one face of a cube equals 9 cm^2, then its total area = ... cm^2.

(Cairo 2016)

i) The lateral area of a cube = $\frac{\text{.....}}{\text{.....}}$ the total area of the cube (in the simplest form).

j) The ratio between the area of one face of a cube and the lateral area = ... :
(in the simplest form).

k) 📖 If the lateral area of a cube is 100 cm^2, then its total area = ... cm^2.

l) If the total area of a cube is 96 cm^2, then the area of each one face = ... cm^2.

m) If the total area of a cube is 600 cm^2, then its volume = ... cm^3.

n) If the total area of a cube is 150 cm^2, then the area of one face = ... cm^2.

(Cairo 2019)

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3 ***Choose the correct answer:***

a) A cube of side length 4 cm, its lateral area = ... cm^2. (80 *or* 16 *or* 64 *or* 96)

b) The area of one face of a cube = ... the total area of a cube. ($\frac{1}{2}$ *or* $\frac{1}{8}$ *or* $\frac{1}{6}$ *or* $\frac{1}{4}$)

c) If the perimeter of one face of a cube = 20 cm, then its total area = ... cm^2. *(Assuit 2017)* (180 *or* 90 *or* 150 *or* 900)

d) The total area of a cube = ... × 6.
(edge length *or* area of one face *or* area of triangle *or* perimeter of one face)

e) If the sum of edge lengths of a cube is 36 cm, then its total area = ... cm^2.
(27 *or* 36 *or* 54 *or* 324)

f) If the total area of a cube = 24 cm^2, then its volume = ... cm^3.
(8 *or* 64 *or* 16 *or* 96)

g) If the lateral area of a cube = 120 cm^2, then its total area = ... cm^2.
(160 *or* 140 *or* 180 *or* 30)

4 If the area of one face of a cube is 9 cm^2, calculate its lateral area.

5 If the perimeter of the base of a cube = 28 cm, calculate the lateral and total area.

6 The sum of edge lengths of a cube is 12 cm, calculate the area of one face and its total area.

7 ***A cube of volume 64 cm^3, find:***

a) The area of one face.
b) The lateral area of a cube.
c) The total area of a cube.

8 If the lateral area of a cube is 36 cm^2, calculate its total area and volume.

9 If the perimeter of one face of a cube equals 20 cm, find its total area.

10 If the total area of a cube is 726 cm^2, calculate the following:
a) The area of one face b) The length of each edge c) The lateral area

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11 If the edge length of a cube is 8 cm, then calculate the ratio between the lateral area and the total area.

12 A box in the shape of a cube without lid, the perimeter of one of its faces is 48 cm, calculate the total area.

13 A water tank in the form of a cube, its inner length is 1.5 m. We want to paint it to prevent the rust. If the cost price of painting one square metre is L.E. 20, calculate the total cost price of painting.

14 A room in the shape of a cube with edge length 4 metres, we want to paint its lateral walls and ceiling. If the cost price of painting one metre is L.E. 9, then calculate the total cost.

15 Youssef used a piece of cardboard in the form of rectangle, whose length is 1.2 m and width is 80 cm to form a cubic box whose edge length is 30 cm. Calculate the area of the remaining paper after forming the box.

16 ***Complete the following table (consider that the unit length is measured in cm):***

Cube	Edge length	Lateral area	Total area
a)	8		
b)		100	
c)			96

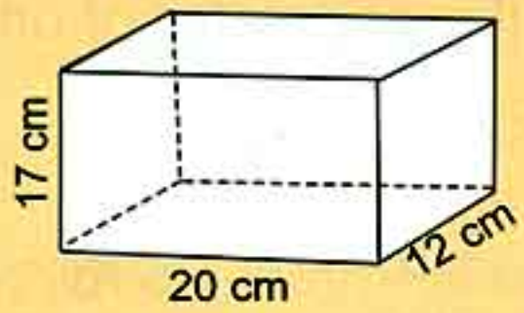
داخلى | inner | خزان | tank | سقف | ceiling

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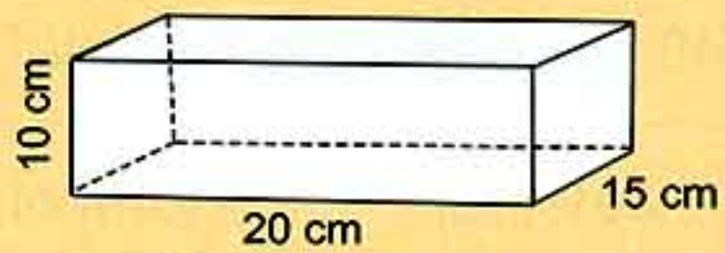
Second The cuboid:

17 ***Calculate the lateral and total area of the following:***

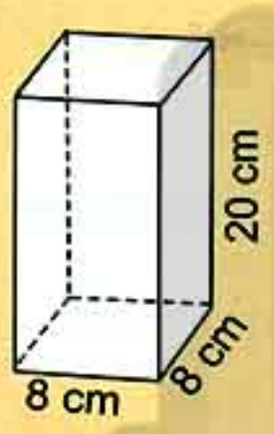
a)



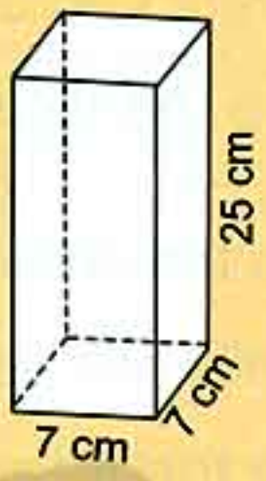
b)



c)



d)



18 ***Complete the following:***

a) The lateral area of the cuboid = ... × *(Giza 2019)*

b) The total area of the cuboid = ... × *(Fayoum 2011)*

c) If the length of a cuboid is 3 cm, its width is 2 cm and its height is 4 cm, then its lateral area = ... cm^2. *(Giza 2019)*

d) If the dimensions of the base of a cuboid are 12 cm and 8 cm and its height is 10 cm, then its lateral area = ... *(Cairo 2013)*

e) A cuboid, the perimeter of its base is 24 cm and its height is 13 cm, then its lateral area = ... cm^2.

f) The lateral area of a cuboid is 130 cm^2 and the perimeter of its base is 26 cm, then its height = ... cm.

g) If the lateral area of a cuboid is 36 cm^2 and the area of one of its bases is 18 cm^2, then its total area = ... cm^2.

h) If the total area of a cuboid is 150 cm^2 and the lateral area is 90 cm^2, then its base area = ... cm^2.

i) 📖 The height of a cuboid whose total area is 120 cm^2 and the dimensions of its base are 4 cm and 6 cm = ... cm.

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19 Find the lateral and total area of a cuboid of length 7 cm, width 5 cm and height 9 cm.

20 A box without a lid whose length is 16 cm, width is 7 cm and height is 19 cm, calculate its lateral area and total area.

21 A box without a lid in the shape of a cuboid whose length is 20 cm, width is 10 cm and height is 3 dm, find its total area.



22 If a box is in the shape of a cuboid with a square base of length 9 cm and height of 20 cm, calculate the lateral and total area.

23 A cube of edge length 10 cm and a cuboid whose length is 8 cm, width is 5 cm and height is 17 cm, calculate the difference between their lateral areas.

24 A box without a lid in the shape of a cuboid with square base of side length 12 cm and height of 9 cm, find its lateral and total area.

25 A swimming pool, whose base dimensions are 40 m and 10 m and height is 2.5 metres. Calculate the lateral and total area. *(Menofia 2011)*



26 A truck box in the form of cuboid, its inner dimensions are 5 m, 2.5 m and 1.6 m. We want to paint the inner box of the truck without the lid, knowing that the cost price of painting one square metre is L.E. 12. Calculate the cost price of the whole paint.



27 A truck box for carrying goods in the form of a cuboid, its inner dimensions are 4 m, 2.5 m and 1.8 m. We want to cover its sides and ceiling with an iron sheet. If the cost price of one square metre of the iron sheet is L.E. 15, calculate the cost of the whole required iron sheet.

truck شاحنة

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28 A room in the shape of a cuboid with dimensions 9 m and 5 cm and height 3 metres, we want to paint its walls and ceiling, if the cost price of painting one square metre is L.E. 15. Calculate the total cost.

29 A room whose length is 5 m, width is 4 m and height is 3.2 m. We want to paint its lateral walls and ceiling. If the cost price of painting one square metre is L.E. 8. Calculate the total cost, knowing that the room has 2 windows and a door whose areas are 8 m^2.



30 A room of a square ground, its length is 4 m and its height is 3 m. It has a door, whose width is 90 cm and height is 2 m and two rectangular windows which are equal in area its of length 160 cm and width 100 cm. Calculate the cost of painting the walls, given that the cost price of painting one square metre is L.E. 9.

31 The inner dimensions of a swimming pool are 30 m, 10 m and 1.5 m. We want to cover it with a square-shaped tile, its side length is 20 cm. Find the number of the tiles required to cover the swimming pool.



32 A cuboid of base dimensions 13 cm and 7 cm and its lateral area is 120 cm. Find its height.

33 A cuboid of square base, its lateral area is 224 cm^2 and its height is 14 cm. Find the side lengths of its base.

34 A cuboid, its height is 15 cm and its base is in the shape of a rectangle whose perimeter is 90 cm and length is 30 cm, calculate the following:

a) The lateral area of cuboid. b) The total area of cuboid.

35 A cuboid, the ratio between the dimensions of its bases is 5 : 3. If the perimeter of its base is 80 cm and its height is 10 cm. Find its total area.

swimming pool حمام سباحة

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36 A box without a lid in the shape of a cuboid, the inner dimensions of its base are 2 m and 3 m and its inner height is 1 m. It is wanted to cover its lateral faces and its floor by metallic sheets, the price of one square metre is L.E. 15, find the total price of the needed metallic sheets. *(Menofia 2017)*

37 A truck box for carrying goods in the shape of a cuboid whose inner dimensions are 4 m, 3 m and 2 m. It's wanted to cover its lateral faces and ceiling with an iron sheet that costs L.E. 30 per square metre, find the total cost of the iron sheets needed. *(Damietta 2017)*

38 If the total area of a cuboid is 180 cm^2 and the lateral area of this cuboid is 120 cm^2 with base perimeter of 20 cm, find the volume of the cuboid.

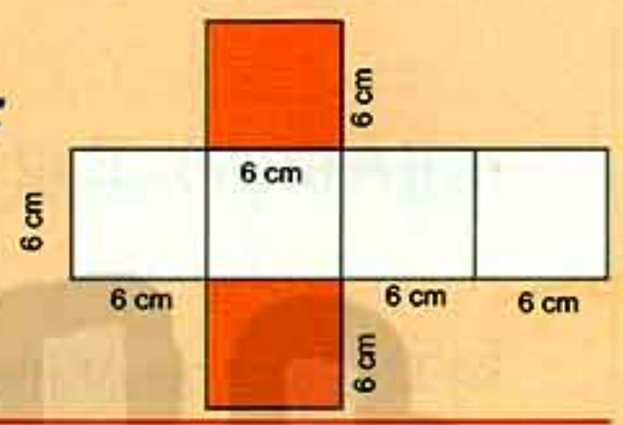
Cumulative Exercise

39 📖 ***When folding the opposite shape, complete:***

a) The formed solid is

b) The lateral area of this solid is

c) The total area of this solid is



40 📖 ***When folding the opposite figure, complete the following:***

a) The solid formed is

b) The lateral area of the solid = ...

c) The total area of the solid = ...

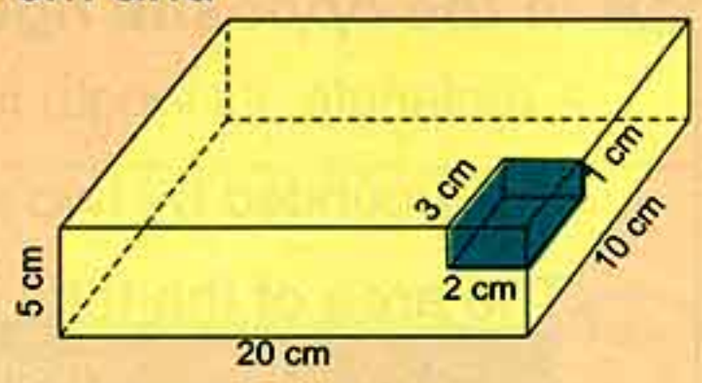


41 The ratio between the dimensions of a cuboid is 3 : 2 : 4. If the sum of the three dimensions is 45 cm, find its lateral area.

Think and Explore

42 The sum of the lengths of the edges of a cuboid is 176 cm and the ratio between the dimensions of the base is 3 : 1. If its height is 1.2 dm, find its total area.

43 A wooden cuboid whose dimensions are 20 cm, 10 cm and 5 cm, if a part of it is cut to form another cuboid whose dimensions are 3 cm, 2 cm and 1 cm, find the total area of the remaining part of the first cuboid and its volume.



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Selected problems from previous exams

3 on Unit

1 Choose the correct answer:

a) A cube of edge length 6cm, then its total area = ... cm^2.

(36 **or** 72 **or** 144 **or** 216) *(Cairo 2017)*

b) If the area of one face of a cube equals 9 cm^2, then its total area = ... cm^2. (12 **or** 27 **or** 36 **or** 54) *(Cairo 2016)*

c) If the diameter of a circle is 8 cm, then its area = ... π cm^2.

(4 **or** 8 **or** 16 **or** 64) *(Sharkia 2017)*

d) If A (2 , 7) , B (2 , 3), then the length of $\overline{AB}$ = ... units.

(3 **or** 4 **or** 5 **or** 7) *(Giza 2019)*

e) The image of the point (–1 , 4) by translation (1 , – 3) is the point

((0, 1) **or** (1, 1) **or** (0, 0) **or** (2, 2)) *(Minia 2019)*

2 Complete each of the following:

a) The total area of the cube with edge length 3 cm = ... cm^2. *(Giza 2016)*

b) A circle its radius is 7 cm, then its area = ... cm^2. ($\pi \simeq \frac{22}{7}$) *(Minia 2019)*

c) If A (1 , 2) , then the image of A by the translation (X + 1 , Y –1) is (..... , ...). *(Beheira 2017)*

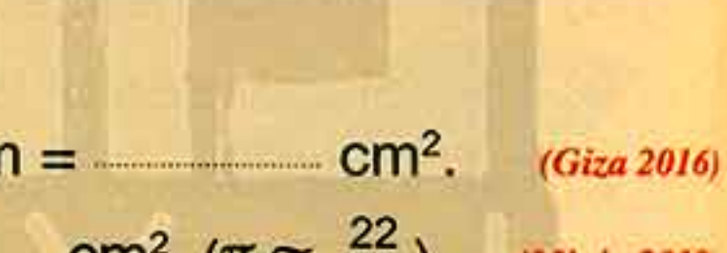
d) The surface area of the circle = ... *(Alexandria 2016)*

e) The lateral area of a cuboid whose dimensions are 6 m, 5cm and 4cm is cm^2 . *(Giza 2019)*

3 In the opposite figure:

A rectangle, its length is 10 cm and its width is 7cm, is surrounded by two semicircles. Find:

The area of the total shape. ($\pi \simeq \frac{22}{7}$) *(Dakahlia 2017)*



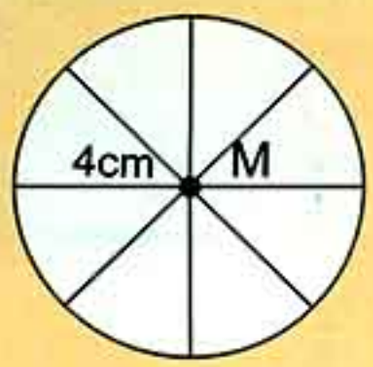
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4 ***In the opposite figure:***

A circle of radius 4 cm is divided into 8 equal sectors. ($\pi \simeq 3.14$)

Find: a) The area of the circle M.

b) The area of one sector. *(Cairo 2019)*

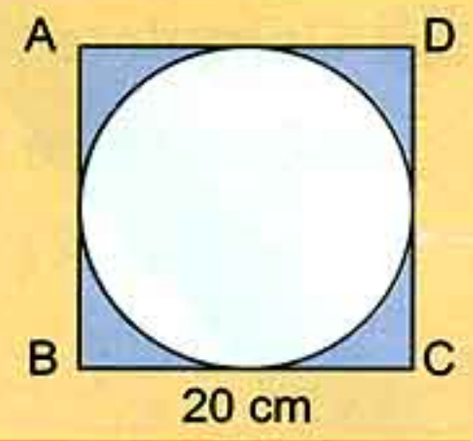


5 ***In the opposite figure:***

ABCD is a square whose side length is 20 cm.

Find: The area of the shaded part. ($\pi \simeq 3.14$)

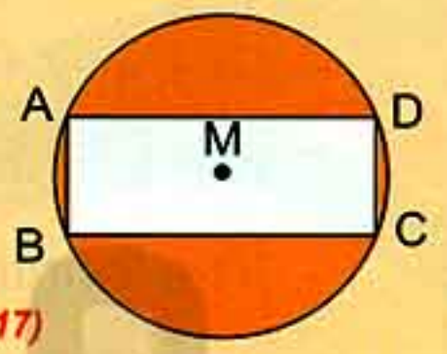
(Beheira 2017)



6 ***In the opposite figure:***

M is a circle whose radius length is 5 cm, a rectangle was drawn inside it. Its length is 8 cm and its width is 6 cm.

Find:The area of the shaded part. (where $\pi \simeq 3.14$). *(Sohag 2017)*



7 A box without a lid its length 16 cm, its width 7 cm and its height 19 cm. Calculate.

1) The lateral surface area. 2) The total surface area. *(Cairo 2019)*

8 The total area of a cube is 486 cm^2. Find:

First: The area of one face. Second: Its lateral area. *(Beheira 2017)*

9 Calculate the surface area of the circle of diameter 14 cm. ($\pi \simeq \frac{22}{7}$) *(Giza 2016)*

10 ***Using the coordinate plane:***

1) Draw the line segment $\overline{AB}$ where A (1 , 2) and B (5 , 2).

2) Find the length of $\overline{AB}$.

3) Draw the image of $\overline{AB}$ by translation (0 , 1) . *(Ismailia 2017)*

Information from UNICEF

Every day I eat a healthy breakfast because it's the most important meal of the day.



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Unit Test 3 on Unit
(From the School Book)

Total mark / 30

..... / 12

1 ***Complete each of the following:***

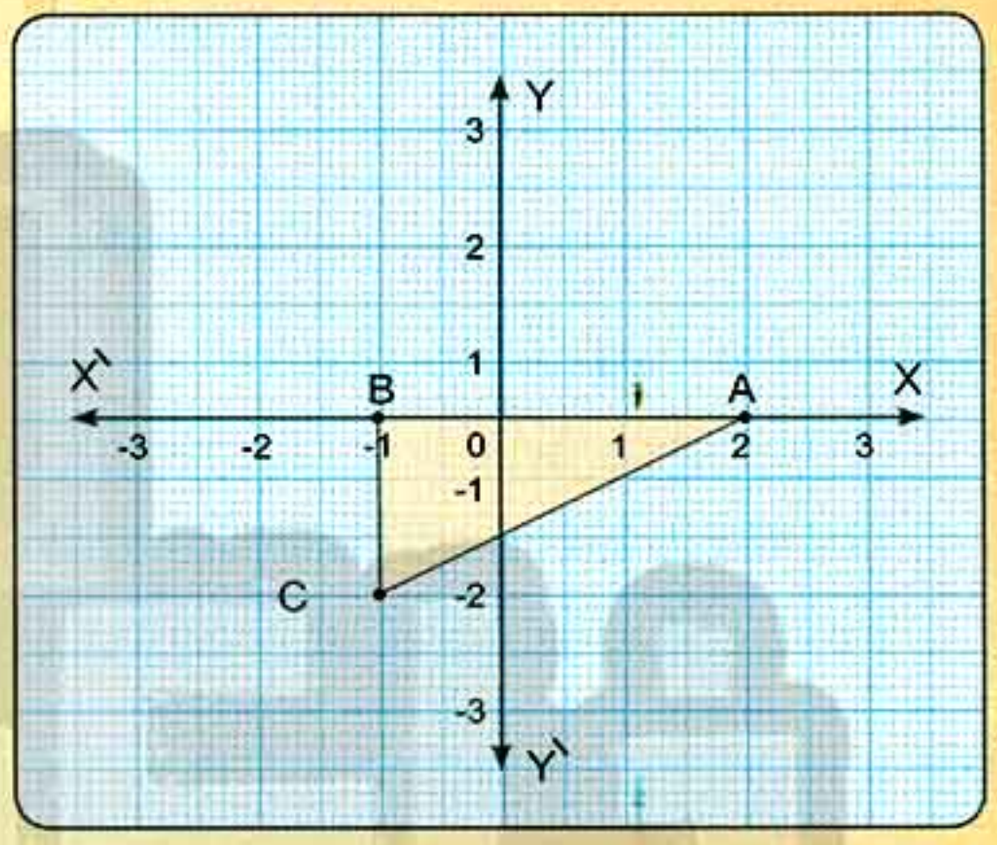
a) Determine the coordinates of the following points: A (... , ...), B (... , ...) and C (... , ...).

b) Find the image of Δ ABC by translation $(x + 2, y + 3)$.

c) The length of $\overline{BC}$ = ...

The length of $\overline{AB}$ = ...

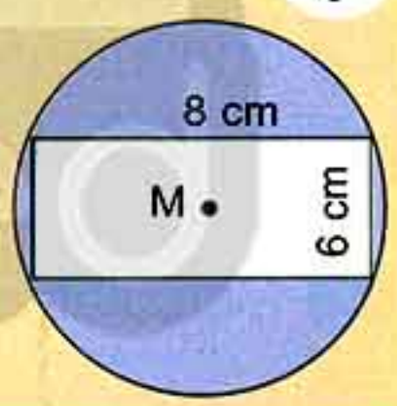
d) Is Δ ABC symmetric or not? Why?



2 ***In the opposite figure:*** / 6

M is a circle of radius length 5 cm, a rectangle is drawn inside it, whose length is 8 cm and width is 6 cm.

Calculate the area of the shaded part. $(\pi \simeq 3.14)$



3 The sum of the edge lengths of a cube is 72 cm. / 6

Calculate its lateral area and total area.

4 A room in the form of a cuboid, its inner dimensions are 7 m length, 5 m width and 3.5 m height. We want to paint its lateral walls and the ceiling. If the cost price of painting one square metre is L.E. 11, calculate the total cost. / 6

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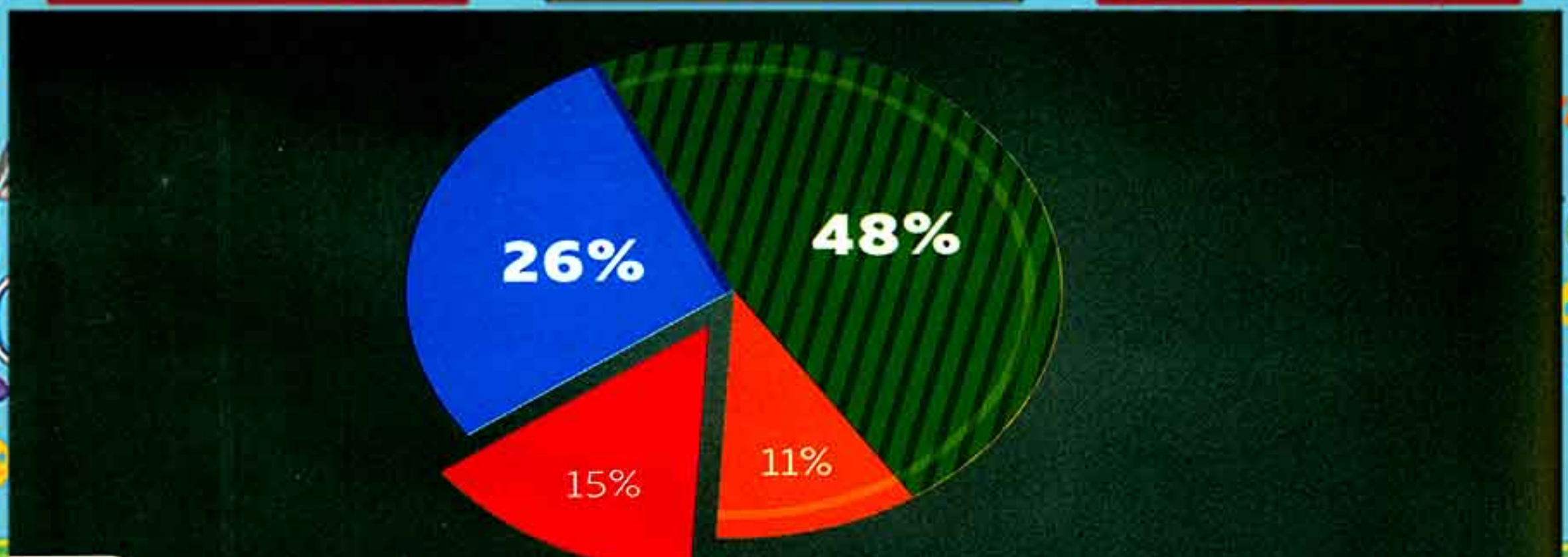


Unit 4

Statistics and probability

- Lesson 1 : Representing statistical data by the circular sector (pie chart)
- Lesson 2 : Random experiment
- Lesson 3 : Probability
- Selected problems from previous exams on Unit (4)
- Test on Unit (4) from the School Book

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Lesson 1

REPRESENTING STATISTICAL DATA BY THE CIRCULAR SECTOR (PIE CHART)

Aims

At the end of this lesson, you will be able to:

(1) divide the surface area of the circle into circular sectors.

(2) calculate the measure of the angle of the sector.

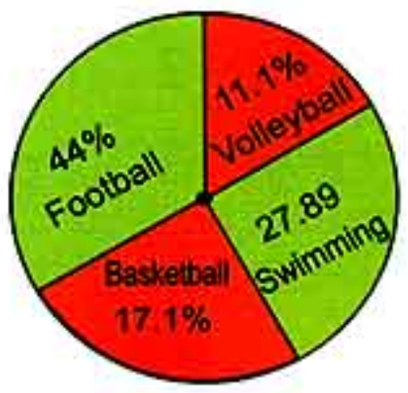
(3) represent data by pie chart.

WARM UP

watch video

- One of the most important methods to represent data is "pie chart".
- In this method we divide the surface area of the circle into circular sectors that differ in their areas according to the data given.

From the opposite chart we can deduce the following:



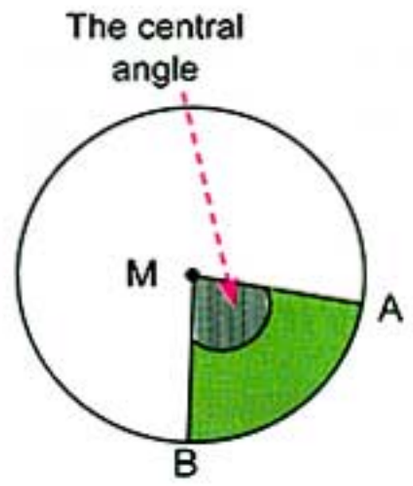
- The most played sport is football.
- The least played sport is volleyball.
- The total area of the circle represents 100% of these data.

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Representing statistical data by the circular sector (pie chart) Lesson 1

Dividing the surface of the circle into different circular sectors:

Notice each of the following:



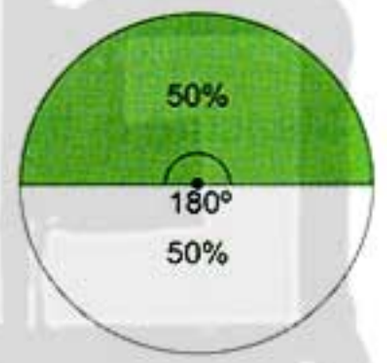
❶ Each circular sector has an angle at the centre called central angle, its vertex lies at the centre of the circle.
Where the sum of the measures of all central angles accumulating around the centre of the circle equals 360°.

❷ The shaded part opposite is a circular sector:



If we know that: its area = $\frac{1}{4}$ of the surface area of the circle.
∴ The measure of its central angle = $\frac{1}{4} \times 360° = 90°$
and it represents $\frac{1}{4} \times 100\% = 25\%$ from the circle.

❸ The shaded part opposite is a circular sector:



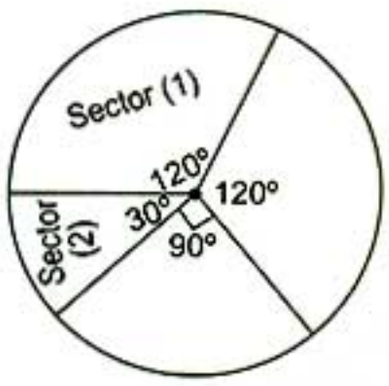
If we know that: its area = $\frac{1}{2}$ of the circle.
∴ The measure of its central angle = $\frac{1}{2} \times 360° = 180°$
and it represents $\frac{1}{2} \times 100\% = 50\%$ from the circle.

❹ The shaded part opposite is a circular sector:



If we know that: its area = $\frac{3}{4}$ of the circle.
∴ The measure of its central angle = $\frac{3}{4} \times 360° = 270°$
and it represents $\frac{3}{4} \times 100\% = 75\%$ from the circle.

❺ In the opposite figure:



ⓐ If the central angle of sector (1) is 120°
∴ Its area = $\frac{120}{360} = \frac{1}{3}$ of the circle.

ⓑ If the central angle of sector (2) is 30°
∴ Its area = $\frac{30}{360} = \frac{1}{12}$ of the circle.

minor sector القطاع الأصغر | major sector القطاع الأكبر | accumulating متجمعة

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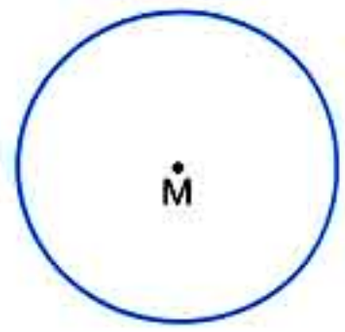
Representing data by using circular sector (pie chart):

Prelude Example

A family spends its monthly income as follows:
25% for rent, 50% for food and other expenses and 25% for savings. **Represent these data using circular sectors (pie chart).**

Solution

ⓐ We considering that the monthly income of the family represents 100% of the area of the circle and draw a circle M with suitable radius length (say 4 cm).



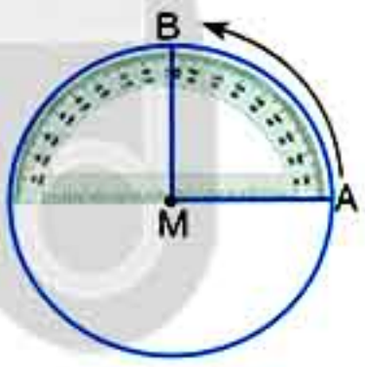
ⓑ Calculate the measure of central angles of each sector as:

Measure of the angle of rent = $360° \times \frac{25}{100} = 90°$

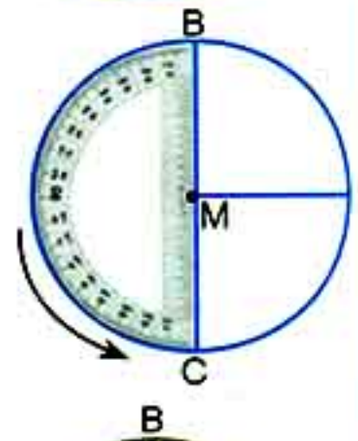
Measure of the angle of food and other expenses = $360° \times \frac{50}{100} = 180°$

Measure of the angle of savings = $360° \times \frac{25}{100} = 90°$

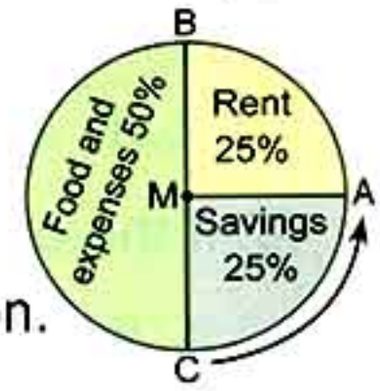
ⓒ Put any point (A) on the circle, join the radius $\overline{MA}$ and draw $\angle AMB$ of measure 90° for rent,
Move the protractor in the same direction. (as shown by the arrow)



ⓓ Start from $\overline{MB}$ to draw $\angle BMC$ of measure 180° for food and other expenses.



ⓔ Start from $\overline{MC}$ to draw $\angle$ CMA of measure 90°,
you will find that the last angle has already been done (90°).
Note: all the measures of angles should be taken in one direction.



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Solved Example 1

The following table shows the percentage of production of four factories that produce electric sets:

Factories	First	Second	Third	Fourth
The percentage of production	25%	50%	10%	

ⓐ Complete the table.

ⓑ Represent these data by using the circular sectors.

Solution

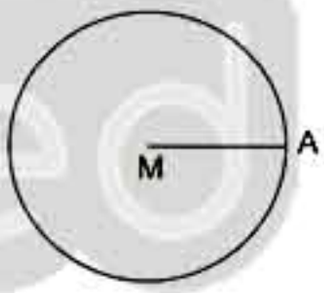
Considering that the total sum of production of the four factories represents 100% of the area of the circle.

ⓐ The percentage of production of the fourth factory = 100% – (25% + 50% + 10%) = 15%

ⓑ We calculate the measure of the central angle for each sector as follows:

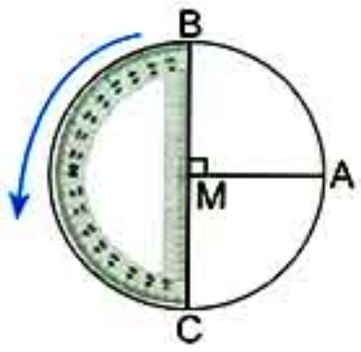
- For the first factory $= \frac{25}{100} \times 360° = 90°$
- For the second factory $= \frac{50}{100} \times 360° = 180°$
- For the third factory $= \frac{10}{100} \times 360° = 36°$
- For the fourth factory $= \frac{15}{100} \times 360° = 54°$

ⓒ Draw circle M with a suitable radius length (say 4 cm.)



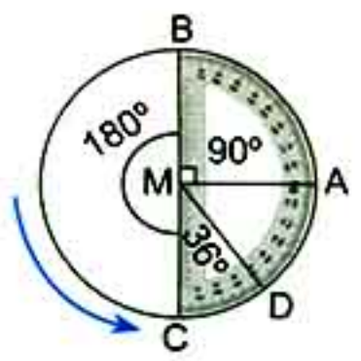
ⓓ Draw radius $\overline{MA}$ then by using the protractor draw:

$\angle$AMB for the first sector where m ($\angle$AMB) = 90°



ⓔ Draw the angle ($\angle$ BMC) of measure 180° to represent the second sector.

ⓕ Draw ($\angle$ DMC), then ($\angle$ DMA) should be = 54°



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Solved Example 2

The following table shows the percentages of some pupils in the sixth primary grade in one school after carrying out a questionnaire about the favourite subjects:

Subjects	Arabic	Maths	Science	Social studies
The percentages of the pupils	35%	25%	22%	18%

Represent these data by a pie chart.

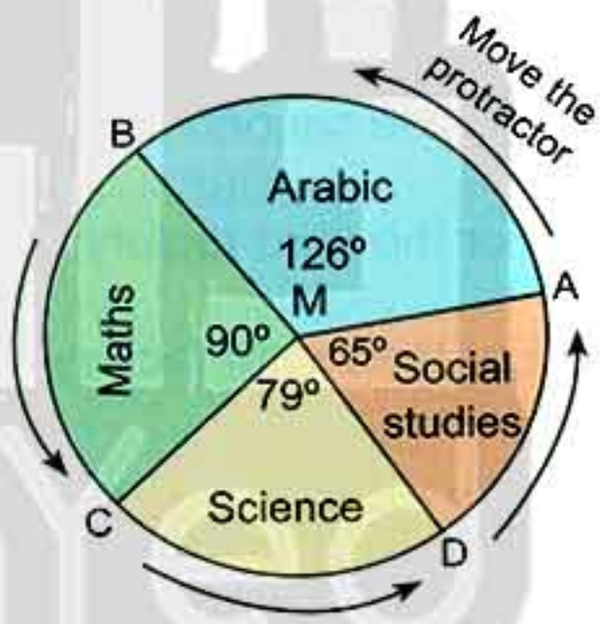
Solution

Considering that the number of all the pupils in the 6th primary grade represents 100% of the area of the circle.

Then calculate the measure of the central angle for each sector as follows:

- The measure of the central angle of Arabic
 $= \frac{35}{100} \times 360° = 126°$
- The measure of the central angle of maths
 $= \frac{25}{100} \times 360° = 90°$
- The measure of the central angle of science
 $= \frac{22}{100} \times 360° = 79.2° = 79°$
- The measure of the central angle of social studies
 $= \frac{18}{100} \times 360° = 64.8° = 65°$

The drawing will be as in the opposite figure.



Check Point

The monthly income of a family is 2460 pounds, the table shows the percentage of its expenditure:

Expenditure	Rent	Food	Other expenses	Savings
Percentage	20%	60%	5%	

(a) Complete the table.

(b) Represent these data by a pie chart.

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Solved Example 3

The following table shows the favourite TV programmes for some pupils in a sixth primary class. Complete the table, then represent the following data by a pie chart:

Programmes	Sports	News	Drama	Movies	Cartoon	Total/Sum
Number of pupils	10	5	3	6	12	

Solution

We consider that the total sum of the pupils represents 100% of the area of the circle:

The total sum of pupils = 10 + 5 + 3 + 6 + 12 = 36

The measure of the central angle of sports $= \frac{10}{36} \times 360° = 100°$

The measure of the central angle of news $= \frac{5}{36} \times 360° = 50°$

The measure of the central angle of drama $= \frac{3}{36} \times 360° = 30°$

The measure of the central angle of movies $= \frac{6}{36} \times 360° = 60°$

The measure of the central angle of cartoon $= \frac{12}{36} \times 360° = 120°$



Then these data can be represented as in the opposite figure.

Check Point

The following table represents the number of studying hours for each subject:

Subjects	Arabic	Maths	Science	English	Social studies
No. of hours	9	10	6	7	4

Represent these data by a pie chart.

A tip:

The total sum of studying hours

= + ... + ... + ... + ... = ... hours.

Considering the total sum of these hours represents 100%.

Calculate the measure of the central angle of each subject, then complete the solution.

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Solved Example 4

Five friends participated in a commercial business, with a capital of L.E. 60000: the first paid L.E. 12000, the second paid L.E. 6000, the third paid L.E. 15000, the fourth paid L.E. 9000 and the fifth paid the remainder.

Illustrate that by using the circular sectors.

Solution

Considering that the capital of the project represents 100% of the area of the circle.

What the fifth person paid $= 60000 - (12000 + 6000 + 15000 + 9000)$

$= 60000 - 42000 = \text{L.E. } 18000$

The measure of the central angle of the first person $= \frac{12000}{60000} \times 360^\circ = 72^\circ$

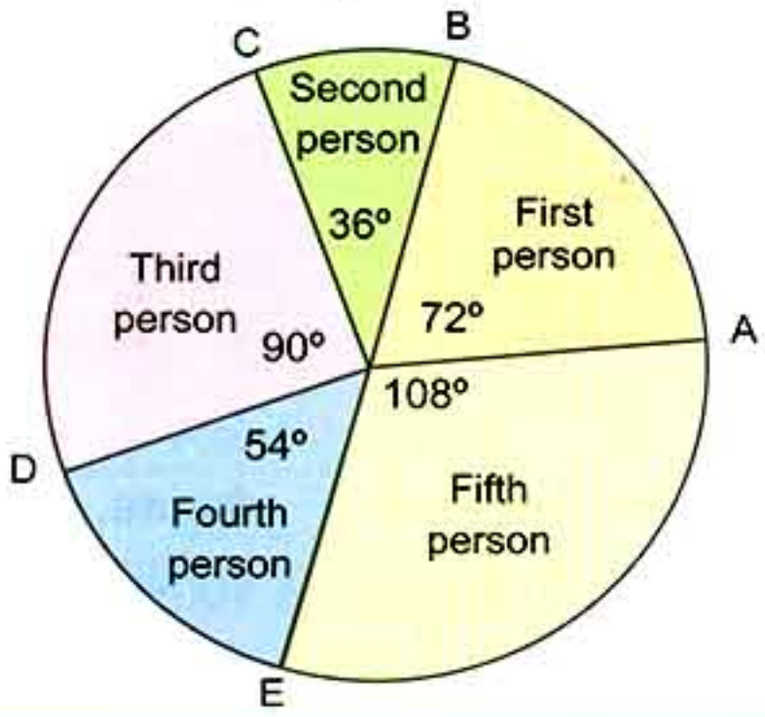
The measure of the central angle of the second person $= \frac{6000}{60000} \times 360^\circ = 36^\circ$

The measure of the central angle of the third person $= \frac{15000}{60000} \times 360^\circ = 90^\circ$

The measure of the central angle of the fourth person $= \frac{9000}{60000} \times 360^\circ = 54^\circ$

The measure of the central angle of the fifth person $= \frac{18000}{60000} \times 360^\circ = 108^\circ$

So, we illustrate that as in the following figure.



capital راس مال | commercial business مشروع تجارى

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EXERCISE 1

Representing statistical data by the circular sector (pie chart)

1 ***Complete the following:***

a) The sum of the measures of the angles accumulating around the centre of a circle equals °

b) The measure of the angle of the circular sector which represents $\frac{1}{2}$ of the circle = ...

c) The measure of the angle of the circular sector which represents $\frac{1}{3}$ of the area of the circle = ...

d) The measure of the angle of the circular sector which represents $\frac{1}{8}$ of the circle = ...

e) If the measure of the central angle of a circular sector is 45°, then it represents of the area of the circle.

f) If the measure of the central angle of a circular sector is 180°, then it represents of the area of the circle.

g) The measure of the angle of the central sector which represents $\frac{1}{18}$ of the area of the circle = ...

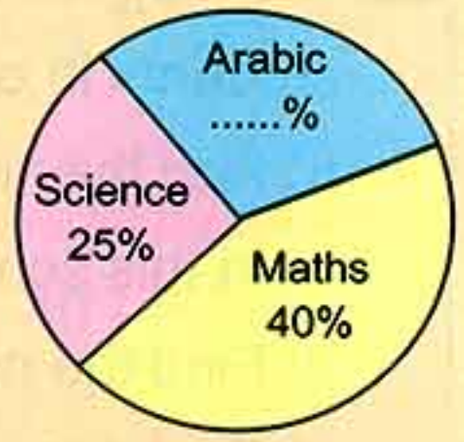
h) A sector whose central angle is 60° represents of the area of the circle.

2 ***The opposite figure shows the percentages of the studying hours for a student in three subjects:***

a) The percentage of the studying hours of maths = ... %.

b) The percentage of the studying hours of science = ... %.

c) The percentage of the studying hours of Arabic = ... %.

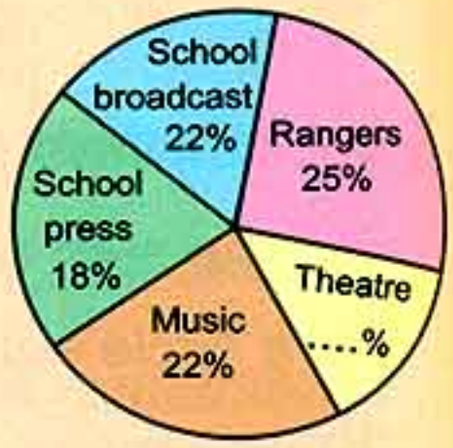


d) The measure of the central angle of the sector that represents maths = ...
The measure of the central angle of the sector that represents science = ...

e) The measure of the central angle of the sector that represents Arabic = ...

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3 The opposite figure shows the favourite hobbies of the pupils of one of the classes in the sixth primary. Study the figure, then answer:



a) What is the measure of the central angle of the sector that represents the school broadcast?

b) What is the measure of the central angle of the sector that represents the theatre?

c) What is the measure of the central angle of the sector that represents the rangers?

d) What is the measure of the central angle of the sector that represents music?

e) What are the hobbies that the least pupils prefer?

f) What are the hobbies that the most pupils prefer?

4 The opposite figure represents the production of 4000 of four kinds of electric sets. Complete the following table, then calculate the central angle corresponding to each kind.



Type of the set	The percentage	The number of the sets	The measure of the central angle
TV	35%	$\frac{4000 \times 35}{100} = 1400$	$\frac{35 \times 360}{100} = 126°$
Washing machine			
Refrigerator			
Cooker			

5 The opposite figure shows the rate of the score of 200 students in one school, study the figure, then answer:



a) Find the number of good students and its percentage in this school.

b) Find the number of the students who pass in this school and its percentage.

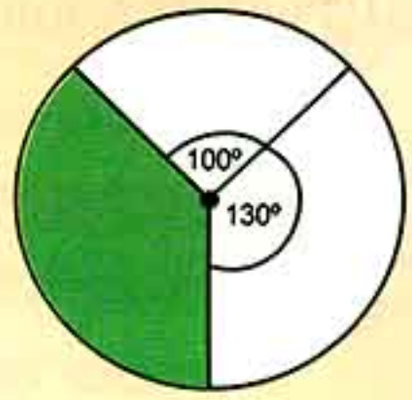
c) Find the number of excellent students in this school and its percentage.

d) What is the measure of the central angle of the sector that represents the weak students?

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6 ***In the opposite figure:***

calculate the measure of the central angle of the shaded circular sector.



7 The following table shows the percentage of egg production on three farms, which a merchant collected to distribute among the grocery stores. Represent these data by using the circular sectors.

The farm	First	Second	Third
The percentage of production	25%	35%	40%

8 The following table shows the percentage of the production of 4 concrete factories:

Factory	First	Second	Third	Fourth
The percentage of production	15%	20%	35%	30%

a) Find the number of tons which are produced in each factory at the end of the year given that the total production is 20 million tons yearly.

b) Arrange these factories in descending order according to their production.

9 The following table shows the distribution of 200 viewers watching TV programmes:

The programmes	Sports	News	Drama	Movies	Songs
The number of viewers	70	20	40	40	30

a) Find the percentage of watching each programme.

b) Represent these data by a pie chart.

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10 The following table shows the favourite TV programmes which the pupils of one of the classes in primary six watch:

Kinds of programmes	Entertainment	Cultural	News	Drama	Sports
Number of pupils	9	5	4	7	11

a) Represent these data by using the circular sectors.

b) What are the programmes that the most pupils prefer, and what are the least preferred ones?

11 One of the families spends its salary as follows: 40% for food, 20% for house rent and 30% for expenses and saves the remainder. Represent these data by using the circular sectors, then answer the following:

a) If the family's monthly income is L.E. 900, how much money does the family save in the year?

b) Another family spends its monthly salary in the same way and saves L.E. 70 monthly, what is the monthly salary of this family?

12 The following table shows the monthly production of 4 factories producing clothes:

Factory	First	Second	Third	Fourth
Production	720	3600	1080	1800

Represent these data using the circular sectors, then answer the following questions:

a) Which factory satisfies the greatest production?

b) What is the percentage of the production for each factory?

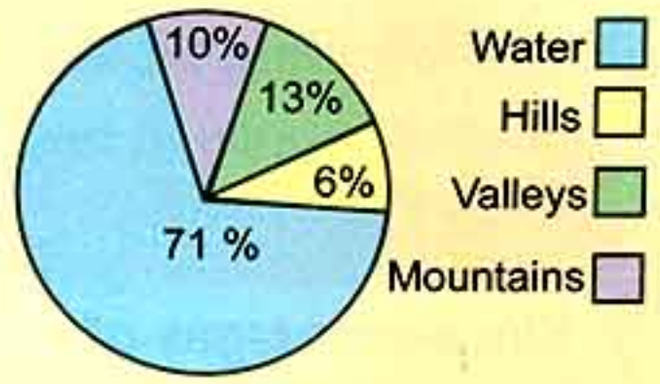
13 The following table shows the percentage of expenditure of an Egyptian family:

Expenditure	Rent	Food	Savings	Others
Percentage	10%	60%		20%

Find the percentage of savings and represent these data by the circular sectors.

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14 The opposite figure shows the distribution of the natural components of the earth's surface. Study the figure, then complete the following table:



The components of the earth's surface	Water natural supplies	Valleys	Hills	Mountains
The percentage of each component				

a) What is the component which represents the smallest ratio of the earth's surface?

b) What is the component which represents the greatest ratio of the earth's surface?

c) What is the measure of the central angle of the sector which represents valleys?

15 The following table shows the percentage of the production of a factory producing 4 kinds of electric sets.

Types of the sets	TV	Washing machine	Refrigerator	Cooker
The percentage of production	35%	20%	15%	30%

Represent these data by using the circular sectors.

16 The following table shows the ratios for producing electronic sets.

Kinds of the sets	1st	2nd	3rd	4th
The ratio of production	30%	15%	40%	15%

Represent these data by a pie chart.

17 Nahid is a clerk in an institution, she divides her salary to monthly expenses as follows: 25% for house rent, 50% for food and 25% for savings.

Represent these data by using the circular sectors.

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18 The following table shows the percentage of the favourite subjects for the sixth primary pupils in one of the schools through carrying out a questionnaire:

Subjects	Arabic	Maths	Science	Social studies
The percentages of the pupils	35%	25%	25%	15%

Represent these data by using the circular sectors.

19 The following table shows Mohammed's studying hours during a week:

Subject	Arabic	Maths	Science	English	Social studies	Total/Sum
Number of hours	9	10	6	7	4	36

Represent these data by a pie chart.

20 The following table shows the percentages of the students who participated in the following school activities:

Activity	Cultural	Sports	Social	Arts
Percentages of students	25%	30%	20%	25%

Represent these data by a pie chart.

21 The following table shows the percentages of the favourite sports for the students in one school.

Favourite sports	Football	Handball	Basketball
The percentage of the students	50%	30%	20%

Represent these data by the circular sectors.

22 The following table shows the ratio of chicken production on four farms:

The farm	1st	2nd	3rd	4th
The ratio of production	10%	35%	30%	

a) Complete the table.

b) Represent these data by the circular sectors.

c) Which farm produces more chickens?

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23 The following table shows the production of chickens on 4 farms in a month:

The farm	1st	2nd	3rd	4th
Percentage	40%	25%	20%	15%

a) Represent these data by the circular sectors.

b) If the total production of these farms in a month was 1200 chickens, find the production of the 1st farm in this month. *(Alex. 2017)*

24 The following table shows the percentages of the production of a factory for three kinds of electric water heaters:

Kinds of electric water heaters	1st	2nd	3rd
The percentage of production	15%	30%	55%

Represent these data by the circular sectors.

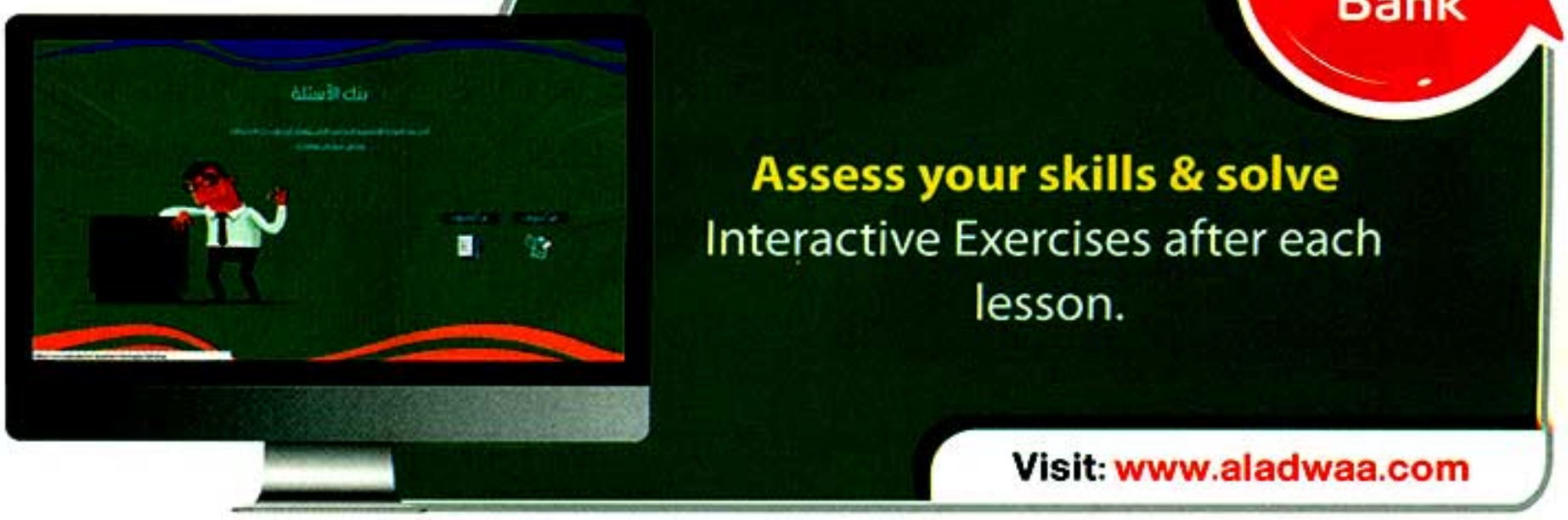
Cumulative Exercise

25 The following represents the ratio between:

The price of a mobile : The price of a television set : The price of a fan

3 : 4 : 2

Represent these data by the circular sectors.



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Lesson 2

RANDOM EXPERIMENT

Aims

At the end of this lesson, you will be able to:

(1) recognise the concept of the random experiment and write the sample space.

(2) calculate the outcomes of a random experiment.

WARM UP

Adel asked himself "If I toss a coin on the table, which face will appear, head (H) or tail (T)?!
This is (a random experiment) because Adel does not sure which face will appear.



Adel draw a ball from a case containing 5 symmetric balls, all of them are red. He said,"I'm sure that the selected ball will be red."
This is (not a random experiment).



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Definitions

① **Random experiment:** it is an experiment in which we can determine all its possible outcomes before carrying it out, but we can't predict certainly which of these outcomes will occur.

② **Sample space (outcomes):** is the set of all possible outcomes for a random experiment and we symbolise it by "S".

Examples for random experiments and their sample spaces:

	Random experiments		Sample space "S" (all possible outcomes)
1	Tossing a coin once and observing the apparent face.		S = { H , T } , H (head) , T (tail) **So,** n (S) = 2 elements. **Note:** n(s) means the number of elements of "s"
2	Tossing a die once and observing the number of dots on the upper face.		S = { 1 , 2 , 3 , 4 , 5 , 6 } **So,** n (S) = 6 elements.
3	A ball is selected at random from a box that contains three symmetric balls (red, yellow and green) and we observe the colour of the drawn ball.		S = { red, yellow, green} **So,** n (S) = 3 elements.
4	Forming all the two-digit numbers that can be formed from the two digits 3 and 5, then selecting one of these numbers randomly.		Tens Units 3 → 3 → 33 3 → 5 → 35 5 → 3 → 53 5 → 5 → 55 S = { 33 , 35 , 53 , 55 } **So,** n (S) = 4 elements.

possible outcomes النواتج الممكنة للتجربة | random experiment تجربة عشوائية | tossing إلقاء | selected اختير | predict يتوقع

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Solved Example 1

In a random experiment of drawing a ball from a box containing 5 symmetric balls (red, yellow, blue, green and white), write the sample space of this experiment.



Solution

The sample space = { red, white, green, blue, yellow }.

Check Point

In an experiment of tossing a die once and observing the dots on the upper face, ***write the sample space.***



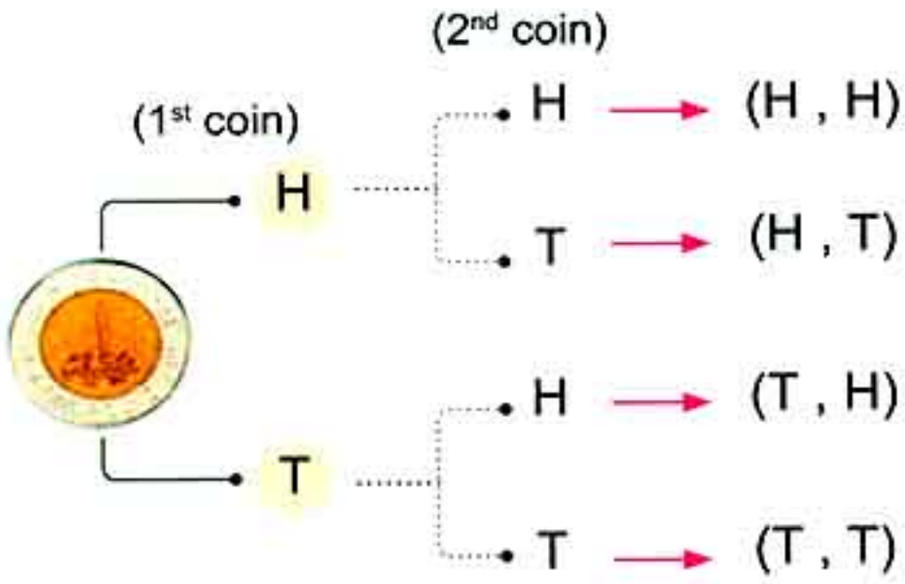
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Solved Example 2

Write the sample space of the random experiment of tossing two distinct coins once and observing the upper face.

Solution

We use the tree diagram to determine the sample space of this experiment as follows:





Then the sample space (S) = { (H , H) , (H , T) , (T , H) , (T , T) }.

distinct | مختلفة

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Note that

1. The sample space of tossing two distinct coins once is equivalent to tossing a coin two consecutive times. (where n (s) = 2 × 2 = 4 elements)
2. The sample space of tossing two dies once is equivalent to tossing a die two consecutive times. (where n (s) = 6 × 6 = 36 elements)

Check Point

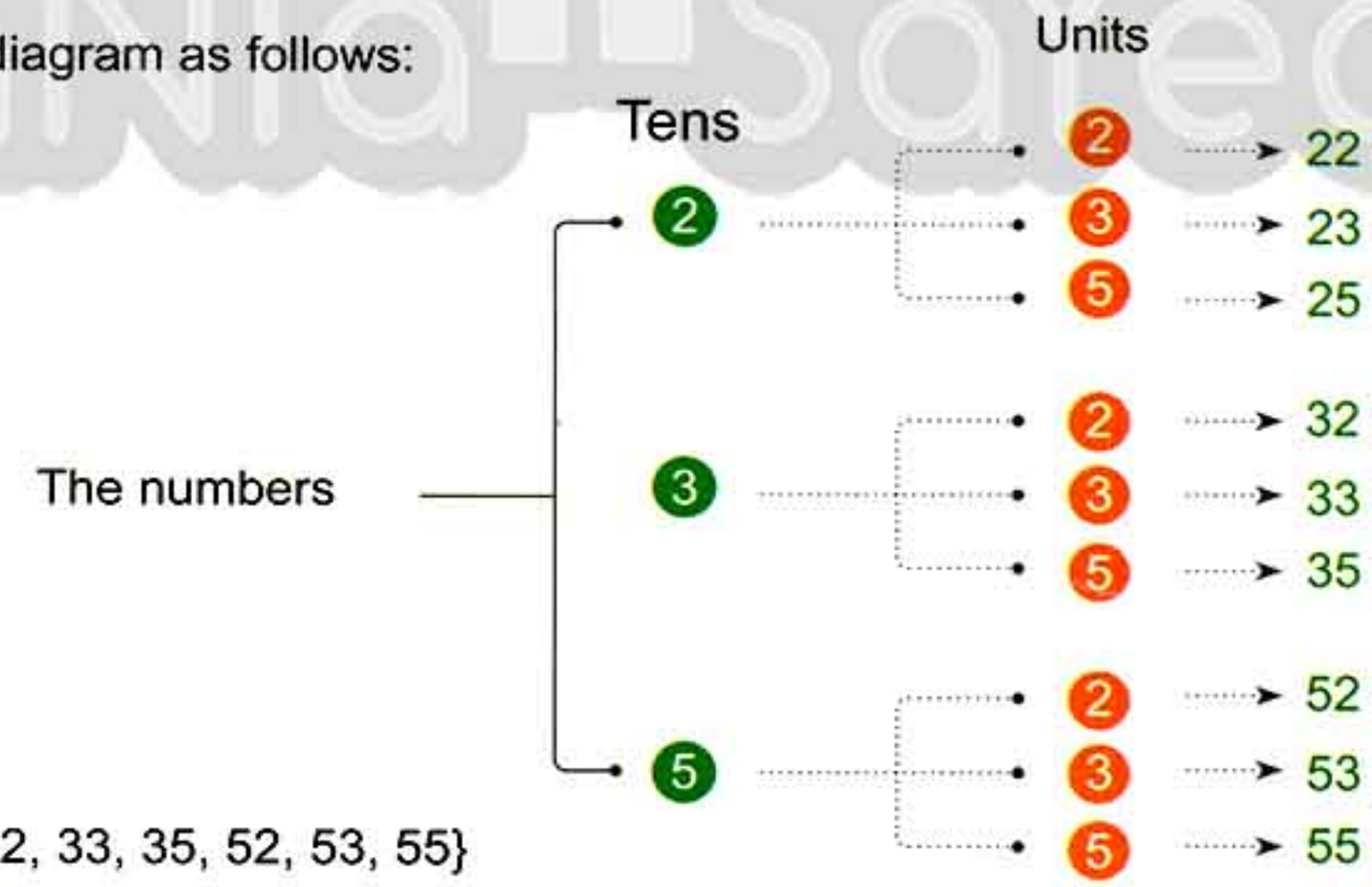
Write the sample space of a random experiment of tossing a coin two consecutive times and observing the upper faces.

Solved Example 3

In a random experiment of forming a number that consists of 2 digits from the set {2 , 3 , 5}, write the sample space and the number of elements of it.

Solution

We use the tree diagram as follows:



S = {22, 23, 25, 32, 33, 35, 52, 53, 55}

n (S) = 9 elements.

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EXERCISE 2 Random experiment

1 ***Complete each of the following:***

a) 📖 Random experiment is

b) 📖 The sample space is

c) In the experiment of drawing a ball from a box that contains three symmetric balls (red, green, blue), the sample space S = { } , n (S) = ...

d) 📖 In the random experiment of tossing a coin two consecutive times and observing the apparent face, the sample space S = { (H , H) , ... }, n (S) = ...

e) In the random experiment of tossing a die once and observing the number on the upper face, the sample space S = { }, n (S) = ...

f) In the random experiment of drawing a ball from 10 balls numbered from 1 to 10 and observing the number labelled on the drawn ball, the sample space S = { }, n (S) = ...

g) In the experiment of drawing a card from a box containing 20 cards numbered from 1 to 20 and observing the number labelled on the drawn card, the sample space S = { } , n (S) = ...

2 In a random experiment of predicting the gender of a newborn of one of relatives, write the sample space.

3 📖 In an experiment of selecting a ball from a box that contains four identical balls (red, yellow, green and blue), observing the colour of the selected ball, write the sample space of this experiment.



4 In a random experiment of getting a number which is formed of two digits from the numbers 3 , 4 , 5, write the sample space (of all possible outcomes).

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5 In a random experiment of tossing a coin two consecutive times and observing the apparent face, write the sample space.

6 A box contains 9 identical cards having the same colour and numbered from 1 to 9. Write the sample space for this experiment.



7 In an experiment of selecting a ball from a box that contains 3 red balls, and 4 yellow balls where all of them are equal in volume, observing the colour of the selected ball, write the sample space of this experiment.

8 In an experiment of forming a 2-digit number from the set {3, 8}, write the sample space.

9 A box contains 10 cards numbered x which satisfies the inequality $5 \leq x \leq 50$: where x is a multiple of 5, write the sample space.

10 In an experiment of tossing a die once and observing the number of points on the face, write the sample space and write the number of its elements.

11 A box contains 5 white balls and 9 red balls, all of them are identical. If a ball is selected randomly, write the sample space.

12 In an experiment of selecting a card from some cards numbered from 10 to 20, write the sample space.

13 In an experiment of tossing a die whose faces are labelled with a, b, c, d, e, f, write the sample space.

14 In an experiment of selecting a letter from the word "Ali", write the sample space.

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Lesson 3

PROBABILITY

Aims

At the end of this lesson, you will be able to:

(1) identify the concept of the event.

(2) recognise how to calculate the probability of an event in the random experiment.

WARM UP

- **In the previous lesson you have studied that:**

 In the random experiment, we can determine all its possible outcomes before carrying out it.

 For example:

 When rolling a dice and observing the number on the upper face then the sample space is:

 { 1, 2, 3, 4, 5, 6 }



- In our life, some times we need to predict accurately which one of the sample space would be occurred.

 Therefore it is important mathematically to calculate the probabilities.

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First What is the event?

Any outcomes you can get from a random experiment are called events.

The event: **In the random experiment, an event is a subset of the sample space.**



For example:

When tossing a regular die once and observing the number that appears on the upper face: S = {1 , 2 , 3 , 4 , 5 , 6}

1. {2, 4, 6} is the event of the appearance of an even number on the upper face.
2. {1, 3, 5} is the event of the appearance of an odd number on the upper face.
3. {2, 3, 5} is the event of the appearance of a prime number on the upper face.
4. { 5 } is the event of the appearance of a number divisible by 5.

Note that:

a. In a random experiment if A, B, C, ... are events, then we write A⊂S, B⊂S, C⊂S and so on.

b. The set of the sample space is an event because S ⊂ S and the empty set ∅ is an event because ∅ ⊂ S.

c. If any element belonging to the event appears, then we say that this event exactly occurs.

For example:

When tossing the die once: A = {2 , 4 , 6}.

Then say that event A occurs when 2 or 4 or 6 appears but if a number 1 or 3 or 5 appears, we say that event A has not occurred.

occur يقع - يحدث

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Second The probability of occurrence of an event:

It is the ratio between the number of elements of an event and the number of elements of the sample space of a random experiment.

It is denoted by "P".

i.e. In a random experiment if A is an event where $A \subset S$,

$$\text{then } P(A) = \frac{n(A)}{n(S)} = \frac{\text{number of elements of (A)}}{\text{number of elements of sample space (S)}}$$

For example:

In an experiment of tossing a die once:

(a) If (A) is the event of appearance of an even number,

then $A = \{2, 4, 6\}$, $S = \{1, 2, 3, 4, 5, 6\}$,

and the probability of event $A = P(A) = \frac{n(A)}{n(S)} = \frac{3}{6} = \frac{1}{2} = 0.5 = 50\%$

(b) If (B) is the event of appearance of an odd number,

then $B = \{1, 3, 5\}$ and $P(B) = \frac{3}{6} = \frac{1}{2} = 0.5 = 50\%$

(c) If C is the event of appearance of a number divisible by 3,

then $C = \{3, 6\}$ and $P(C) = \frac{2}{6} = \frac{1}{3}$

(d) If D is the event of appearance of a number greater than 6,

then $D = \{\ \}$ and $P(D) = \frac{n(D)}{n(S)} = \frac{\text{zero}}{6} = \text{zero}$

(Event $\varnothing$ is called impossible event (cannot occur).)

(e) If E is the event of appearance of a number less than 7, then

$E = \{1, 2, 3, 4, 5, 6\} = S$ and $P(E) = P(S) = \frac{n(E)}{n(S)} = \frac{6}{6} = 1$

(Event S is called the sure event which always occurs.)

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Solved Example 1

A box contains 10 symmetric cards numbered from 1 to 10. A card is selected at random, **calculate the probability of each of the following events:**



ⓐ Event A where A is a number divisible by 3.

ⓑ Event B where B is a number divisible by 7.

ⓒ Event C where C is a number greater than 10.

ⓓ Event D where D is a number, that satisfies the inequality $0 < D < 11$.

Solution

$S = \{1 , 2 , 3 , 4 , 5 , 6 , 7 , 8 , 9 , 10\}$

ⓐ $A = \{3 , 6 , 9\}$, $n(A) = 3$

So $P(A) = \frac{n(A)}{n(S)} = \frac{3}{10} = 0.3 = 30\%$

ⓑ $B = \{7\}$, $n(B) = 1$

So $P(B) = \frac{n(B)}{n(S)} = \frac{1}{10} = 0.1 = 10\%$

ⓒ $C = \{\}$, $n(C) =$ zero (impossible event) , So $P(C) = \frac{n(C)}{n(S)} = \frac{\text{zero}}{10} =$ zero

ⓓ $D = \{1 , 2 , 3 , 4 , 5 , 6 , 7 , 8 , 9 , 10\}$, $n(D) = 10$

then $P(D) = \frac{n(D)}{n(S)} = \frac{10}{10} = 1 = 100\%$ (certain event)

Pay attention:

There is a difference between event A and its probability P (A) where event A is a subset of S, while P (A) is a real number such that $0 \leq P(A) \leq 1$

Check Point

A class of 40 students has taken a math exam and its maximum mark is 50: if 30 students got less than 40 marks and 10 students got (40 up to 50) marks, ***calculate the probability of:***

a) Event A where A is a student who got less than 40 marks.

b) Event B where B is a student who got a mark satisfying the inequality $B \geq 40$

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Important notes

1. The probability of any event is not less than zero and not greater than 1

 So, If $(A \subset S)$, then $0 \leq P(A) \leq 1$

2. The impossible event: the probability of its occurrence is zero. i.e. $P(\varnothing) = 0$

 EX: The probability that you will fly to the moon tomorrow is zero (no chance).

3. The sure (or certain) event:

 The probability of its occurrence is one. i.e. $P(S) = 1$

 EX: The probability that the earth will still be turning tomorrow is one (certain).

4. The probability of any event is written in fraction or decimal or percentage form.

5. The total sum of all probabilities of all the different events which contain only one element from the sample space "s" is equal one 1

For example:

(a) In the experiment of tossing a coin $S = \{T , H\}$,

then $P(H) + P(T) = \frac{1}{2} + \frac{1}{2} = 1$

(b) In the experiment of tossing a dice $S = \{1 , 2 , 3 , 4 , 5 , 6\}$.

So, $P(1) + P(2) + P(3) + P(4) + P(5) + P(6) = P(S)$

$= \frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} = 1$

(c) • In the experiment of tossing a die once, A is the event of appearance of an even number.

So, $A = \{2 , 4 , 6\}$ and the probability of occurrence of A is $p(A)$

$= \frac{3}{6} = \frac{1}{3}$

• If B is the event of appearance a number not even

(or non - occurrence of A), then $P(B) = 1 - P(A) = 1 - \frac{1}{3} = \frac{2}{3}$

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Solved Example 2



A bag contains 15 symmetric cards numbered from 1 to 15. We mixed them. If a card is drawn at random, calculate the probability of the following events:

(a) The event of getting a card that carries a number satisfying the equation $2x - 3 = 11$

(b) The event of getting a card that carries a number satisfying the inequality $8 \leq x < 11$

(c) The event of getting a card carrying a number satisfying the equation $2x - 3 = 6$

(d) The event of getting a card carrying a number satisfying the inequality $x < 6$

Solution

S = {1 , 2 , 3 , 4 , 5 , 6 , 7 , 8 , 9 , 10 , 11 , 12 , 13 , 14 , 15} , n (S) = 15

(a) $2x - 3 = 11$ So $2x = 11 + 3$ So $2x = 14$ Then $x = 7$

Then the event = { 7 }.

The number of its elements is one.

The probability of this event = $\frac{1}{15}$

(b) The event is {10 , 9 , 8}, then its probability = $\frac{3}{15} = \frac{1}{5}$

(c) $2x - 3 = 6$ So $2x = 6 + 3$ So $2x = 9$ Then $x = \frac{9}{2} = 4.5$

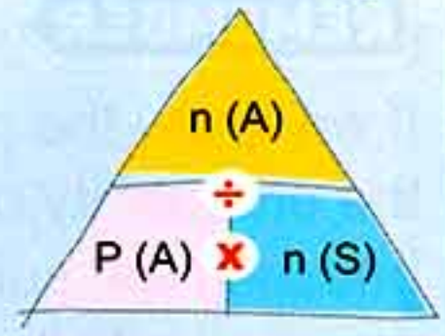
Therefore the set of the event = $\varnothing$ Then its probability = $\frac{\text{zero}}{15}$ = zero

(d) The set of elements of the event is {1 , 2 , 3 , 4 , 5}, its probability = $\frac{5}{15} = \frac{1}{3}$

REMARK

If we know the probability of an event "P (A)" and the number of elements of the sample space n (S), then we can get the number of the elements of this event "n (A)".

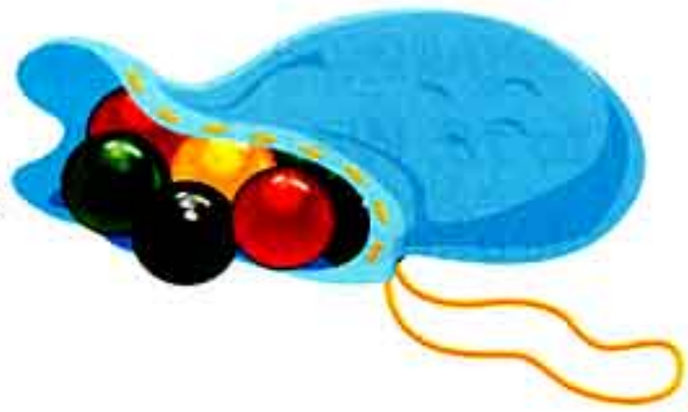
i.e. Since P (A) = $\frac{n(A)}{n(S)}$, then n (A) = n (S) x P (A).



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Solved Example 3

A bag contains 25 symmetric balls of different colours. Dina drew a ball at random. If you know that the probability of the red ball equals $\frac{2}{5}$, find the number of the red balls in this bag.



Solution

$\because$ The probability of the event of a red ball = $\frac{\text{the number of red balls}}{\text{the number of the sample space}}$,

$\because \frac{2}{5} = \frac{\text{n (red balls)}}{25}$

$\because$ The number of red balls = $25 \times \frac{2}{5} = 10$ balls.

Check Point

In a meeting for discussing the problem of the workers in a factory, 100 workers of men and women were attending. If the probability of choosing a man to discuss the problems of the workers is $\frac{3}{5}$.

Calculate the number of men and the number of women in this meeting.

A tip:

$\because \frac{3}{5} = \frac{\text{n (of men)}}{\text{n (s)}}$ $\therefore \frac{3}{5} = \frac{\text{n (of men)}}{100}$

$\therefore$ n (of men) = ...

and n (of women) = ... –

REMEMBER

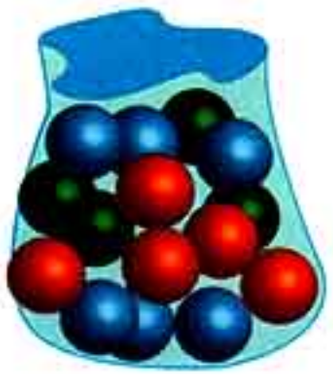
If we know the probability of an event A which is "P (A)", we can get the probability of non-occurrence of A as follows:
because the sum of the probabilities of all events which contain only one element = 1, then the probability of non-occurrence of A = 1 – P (A).

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كتاب Gem موقع ذاكرولى التعليمى الصف السادس الابتدائى

Solved Example 4

A bag contains 15 symmetric balls, 5 of them are red, 6 are blue and 4 are green. A ball is drawn at random. Calculate the probability of each of the following events.



(a) The drawn ball is blue.

(b) The drawn ball is not blue.

Solution

(a) The probability that the drawn ball is blue = $\frac{\text{the number of the blue balls}}{\text{the number of total balls}} = \frac{6}{15} = \frac{2}{5}$.

(b) The probability that the drawn ball is not blue = $1 - \frac{2}{5} = \frac{3}{5}$

Solved Example 5

A class of 30 students, 21 of them succeeded in science. A student is chosen randomly. Find the probability that the chosen student:



(a) succeeded in science. (b) failed in science.

Solution

The number of the elements of the sample space n (S) = 30

(a) Let A be the event that the chosen student succeeded in science.

i.e. n (A) = 21, therefore P (A) = $\frac{n(A)}{n(S)} = \frac{21}{30} = \frac{7}{10} = 70\ \%$.

(b) Let B be the event that the chosen student failed in science.

i.e. n (B) = 30 – 21 = 9, therefore P (B) = $\frac{n(B)}{n(S)} = \frac{9}{30} = \frac{3}{10} = 30\ \%$.

Another solution:

P (B) = 1 – P (A)

$= 1 - \frac{7}{10} = \frac{3}{10} = 30\%$

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EXERCISE 3 Probability

1 ***Complete the following:***

a) The probability of the occurrence of the impossible event = ... ,
while the probability of the occurrence of the sure event = ...

b) For any event A of the sample space of a random experiment, ... ⩽ P (A) ⩽

c) If a coin is tossed once, then the probability of the appearance of a head = ...

d) If a card is chosen at random from 15 cards numbered from 1 to 15, then the probability of getting a prime number = ...

e) If a die is tossed once, then the probability of getting a number more than 6 on the upper face = ...

f) A box contains 5 red balls, 3 white balls and 7 black balls: if a ball is drawn at random, then the probability that the drawn ball is black = ...

g) If a die is tossed once, then the probability of the appearance of a number less than one is

h) If the probability of occurrence of an event (A) is $\frac{5}{7}$, then the probability of its non-occurrence is

i) If a die is tossed once, then the probability of the appearance of a prime number on its upper face is

j) A class has 40 students, 16 of them are girls, if a student is chosen at random, then the probability of choosing a boy = ...

k) The probability of choosing digit 3 of number 9733354 randomly is

l) If the probability of success of a student is 65%, then the probability of his failure = ...

m) A class of 45 students, 25 of them are boys, if a student is chosen at random, then the probability that the chosen student is a girl = ...

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2 ***Choose the correct answer from those between the brackets:***

a) 🕮 P (∅) = ..., where ∅ is the null set. (0 **or** 2 **or** 1 **or** $\frac{1}{2}$)

b) 🕮 P (S) = ..., where S is the sample space.(zero **or** 2 **or** 1 **or** 0.8)

c) Which of the following values is the probability of the occurrence of an event?
(1.2 **or** – 0.4 **or** 315% **or** 75%)

d) Which of the following values is the probability of occurrence of an event?
(1.4 **or** 125% **or** 24% **or** – 0.7)

e) If a die is tossed once, then the probability of the appearance of a number more than 4 on the upper face is ($\frac{1}{6}$ **or** $\frac{1}{3}$ **or** $\frac{1}{2}$ **or** 1)

f) A box contains 20 cards numbered from 1 to 20. If a card is drawn at random, then the probability that the selected card carries a number divisible by 6 is ($\frac{3}{20}$ **or** $\frac{4}{20}$ **or** $\frac{5}{20}$ **or** $\frac{6}{20}$)

g) A bag contains 5 red balls, 3 white balls and all balls are identical. If a ball is drawn at random, then the probability that the drawn ball is white is ($\frac{3}{5}$ **or** $\frac{3}{8}$ **or** $\frac{5}{8}$ **or** $\frac{5}{3}$)

h) If a die is tossed once, then the probability of getting a number more than 6 on its upper face = ... (∅ **or** zero **or** $\frac{1}{6}$ **or** $\frac{1}{3}$)

i) A class of 20 boys and 20 girls: if a student is chosen at random, then the probability that the chosen student is a girl is ($\frac{1}{20}$ **or** $\frac{4}{9}$ **or** $\frac{1}{2}$ **or** $\frac{5}{9}$)

j) If a die is tossed once, then the probability of getting an integer number that satisfies the inequality $2 < x < 3$ is ($\frac{1}{2}$ **or** $\frac{1}{3}$ **or** $\frac{1}{4}$ **or** 0)

k) If a die is tossed once, then the probability of getting a number less than 4 is
($\frac{5}{6}$ **or** $\frac{2}{3}$ **or** $\frac{1}{2}$ **or** $\frac{1}{6}$)

l) If the probability of success of a student is 70%, then the probability of his failure is (0.7 **or** 0.07 **or** 0.3 **or** 0.03)

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3 In a random experiment of drawing a card from 7 cards, numbered from 1 to 7, write the sample space, then find the probability of the following:

a) Event A where A is the appearance of a number less than 4.

b) Event B where B is the appearance of an odd number.

c) Event C where C is the appearance of a number more than 5.

4 A box contains 8 white and 12 red balls. A ball is selected without looking inside the box, find the following probabilities:

a) The selected ball is white. b) The selected ball is red. c) The selected ball is blue.

5 In an experiment a student is chosen at random from a class of 40 students where 32 students have succeeded in maths test and 35 students have succeeded in Arabic test. Find the probability of:

a) Event A where A is the event that the student has succeeded in Arabic.

b) Event B where B is the event that the student has succeeded in maths.

c) Event C where C is the event that the student has failed in maths.

6 A box contains 8 cards of even numbers which lie between 2 and 20. If a card is drawn at random, calculate the probability of the following:

a) The event A where A is the appearance of the multiple of number (4).

b) The event B where B is the appearance of an even number.

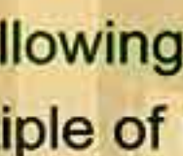
c) The event C where C is the appearance of a number divisible by 3.

7 In an experiment of tossing a regular die once observing the number of dots on the upper face, find the probability of the following:

a) Event A where A is the appearance of a number less than 4.

b) Event B where B is the appearance of a number satisfying the inequality ($B \leq 5$).

8 A cube is designed such that each two opposite faces carry one of the digits 2 , 4 and 6 , the cube is tossed.



a) Write the sample space of this random experiment.

b) Calculate the probability that the number we get on the apparent face is 2

c) What is the probability that the number we get on the apparent face is even?

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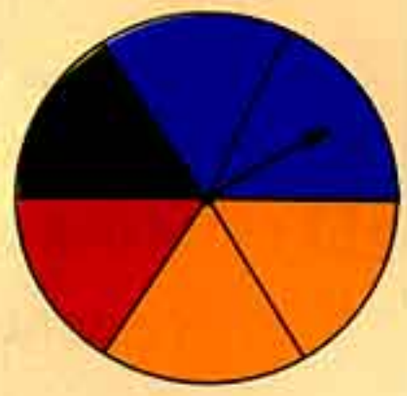
9 In the opposite spinner if all the circular sectors are equal in area, find the probability that the pointer stops at:

a) The yellow colour.

b) The blue colour.

c) The red colour.

d) What is the probability that the pointer does not stop at the green colour?



10 a) A basket contains 48 identical balls. If the probability of drawing a white ball is equal to $\frac{5}{6}$, find the number of white balls.

b) In an experiment of tossing a die two consecutive times and observing the apparent number in each time on the upper face, calculate the probabilities that.

(1) The sum of the two apparent numbers is more than 10.

(2) The sum of the two apparent numbers is greater than "1" and less than "4".

11 A container contains 6 green balls, 8 red balls and 6 blue balls: if a ball is drawn at random, then find the probability that the drawn ball is:

a) blue b) white c) not red



12 In an experiment of forming a 2-digit number from the digits {3 , 5}, write the sample space, then find the probability of the following events:

a) Event A where A is the units digit that equals the tens digit.

b) Event B where B is the tens digit is odd.

c) Event C where C is the tens digit is even.

13 In an experiment of drawing a card at random from 20 cards numbered from 1 to 20, write the sample space, then find the probability of each of the following:

a) Event A where A is the appearance of an odd number.

b) Event B where B is the appearance of an even number.

c) Event C where C is the appearance of a prime number.

d) Event F where F is the appearance of a number divisible by 5.

e) Event G where G is the appearance of the multiple of number 3.

f) Event H where H is the appearance of a factor of number 12.

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14 In an experiment of tossing a die once and observing the appearance of a number on the upper face, write the sample space, then find the probability of event A where A is the event of getting a number ≤ 3.

15 In one of the weight loss centres, 10 ladies suffering from overweight were waiting to enter for meeting the specialized doctor, if the weights of 4 of them are between 100 and 110 kg and the weights of the others are between 110 and 120 kg,



find the following probabilities:

a) The entrance of a lady of weight less than 110 kg.

b) The entrance of a lady of weight more than 110 kg.

c) The entrance of a lady of weight 90 kg.

16 A box contains 4 white balls and 6 red balls, all of them are identical, if one ball is drawn randomly. Find the probability that the drawn ball is:

a) White.

b) Not white.

17 In an experiment of forming a 2-digit number from the set of digits {7 , 8}.

Find is the probability of:

a) Event A: the units digit is an odd number.

b) Event B: the sum of the two digits is 15.

c) Event C: the two digits are equal.

18 In an experiment of throwing a fair die once and observing the number of dots on the upper face, write the sample space, then find the probability of each of the following events:

a) Getting a number greater than 6.

b) Getting a number satisfying the inequality $3 < x < 5$.

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19 A basket contains 15 balls numbered from 1 to 15, if one of the balls is chosen randomly, write the sample space of this experiment, then find the probability that the chosen ball:

a) carried an odd number.

b) carried a prime number.

c) carried a number divisible by 3.

20 In an experiment of forming a number consisting of two digits without repeating the number using the set of numbers {1 , 2 , 3}, find:

a) The probability of getting an odd prime number.

b) The probability of getting an even number.

21 A box contains 120 balls, some of them are white and the rest is red. If the probability of drawing a white ball is $\frac{1}{3}$ then find the number of red balls.

22 In a meeting for discussing the problems of the workers in a factory, 100 workers of men and women were attending. If the probability of choosing a man to discuss the problems of the workers is $\frac{2}{5}$, calculate the number of the men and the number of women in this meeting.

23 In the competition of choosing the ideal student in one of the schools, 63 students applied for the competition, if the probability that one of the girls is the ideal student is $\frac{4}{9}$, find the number of girls who participated in this competition.

24 By using cardboard, cut 10 equal square or rectangular cards having the same colour, then label each one of them from numbers (1 to 10), then put them in a bag that is not transparent and mix them carefully and choose one of them at random. Calculate the probability of the following events:

a) Event A: the appearance of a number more than 7.

b) Event B: the appearance of an odd number.

c) Event C: the appearance of a number that satisfies the inequality: $c \leq 10$

d) Event D: the appearance of a number that satisfies equation: $d - 4 = 2$

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25 One of the companies that produce fridges made a survey about its production for a group consisting of 500 women to get their opinions about the sizes of these fridges. The results were as follows:



Size of the fridge in feet	6	10	12	14	16	Total
Number of women	25	90	165	130	90	500

If a woman is chosen randomly, what is the probability that her favourite size is?

a) 6 feet. b) 10 feet. c) 12 feet. d) 14 feet. e) 16 feet.

26 Two players play football, during training the first one scored 18 goals from 24 penalty kicks, the second player scored 20 goals from 30 penalty kicks, find:

a) The probability that the 1st player will score goals from a penalty kick in the game.

b) The probability that the 2nd player will score goals from a penalty kick in the game?

c) Which one of the two players should be chosen to kick a penalty in the game?

27 A box contains 5 symmetric cards numbered from 1 to 5. One card is drawn randomly, write the sample space, then calculate the probabilities of each of the following:

1) Event A where A is the appearance of an even number.
2) Event B where B is the appearance of an odd number.
3) Event C where C is the appearance of a number greater than 5

28 A box contains 5 white balls and 8 red balls and all of them are symmetric. If a ball is selected without looking, what is the probability that the selected ball is:

1) white. 2) red.

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Cumulative Exercise

29 In one of the classes of primary six the teacher of maths classified the levels of the students whose number is 40 in his subject into (weak - intermediate - advanced), and recorded the data in the following table:

The level	Weak	Intermediate	Advanced	Sum
Number of students	5	25	10	40

One of the students in this class is chosen at random.

(1) Calculate the probability of choosing:

a) a weak student. b) an advanced student. c) an intermediate student.

(2) Represent the data of the table by a pie chart.

Think and Explore

30 A class has 40 students, the number of boys is greater than the number of girls by 12 If one student is chosen randomly, find the probability that the student is a girl.



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Selected problems from previous exams

4 on Unit

1 The following table shows the percentage of production of chickens on four farms which is distributed to shops within one month.

The farm	1st	2nd	3rd	4th
The percentage of production	10%	35%	30%	25%

Represent these data by a pie chart. *(Marsa Matrouh 2017)*

2 The following table shows the percentages of the number of students participating in the school activities.

Represent these data by the circular sectors. *(South Sinai 2017)*

The activity	Cultural	Sports	Social	Arts
The percentage	20%	35%	25%	20%

3 The following table shows the percentages of the number for the students who participate in the school activities.

The activity	Cultural	Sports	Arts
The percentage	25%	40%	35%

Represent these data by a pie chart. *(Ismailia 2017)*

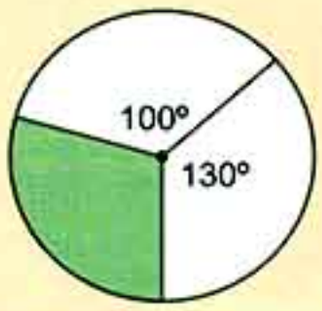
4 Complete each of the following:

1) When tossing a coin once, then the probability of getting a head or tail = ...

(Giza 2019)

2) In the opposite figure:

The measure of the central angle of the shaded circular sector = ...°



(Cairo 2016)

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3) A box contains 5 white balls, 3 red balls and 8 blue balls, if a ball is chosen randomly, then the probability that the chosen ball is red = ... *(Giza 2019)*

4) If n (S) = 12, n (A) = 4 where A ⊂ S, then P (A) = $\frac{\ldots\ldots}{\ldots\ldots}$ *(Qalubia 2017)*

5) The sum of measures of all accumulative angles at the centre of a circle equals° *(Kafr El-Sheikh 2016)*

6) The measure of the angle of the circular sector which represents $\frac{1}{8}$ of the surface area of the circle = ... *(Cairo 2017)*

7) A class of 50 pupils. If the probability of success for those pupils in the final exam is 0.8, the expected number for the pupils who will succeed = ... pupils. *(Gharbia 2017)*

5 ***Choose the correct answer from those between the brackets:***

1) If a fair die is tossed once, then the probability of appearing number 5 = ... (zero *or* $\frac{1}{6}$ *or* $\frac{5}{6}$ *or* 1) *(Giza 2016)*

2) When tossing a die once, then the probability of getting a number divisible by 5 equals = ... (0 *or* $\frac{1}{6}$ *or* $\frac{5}{6}$ *or* 1) *(Cairo 2017)*

3) If A = S, then P (A) = ... (1 *or* 0 *or* 2 *or* 3) *(Kafr El-Sheikh 2016)*

4) The probability of the impossible event = ...
(1 *or* 0 *or* 2 *or* 3) *(Sohag 2019)*

5) The measure of the angle for the sector of half a circle is
(120° *or* 90° *or* 270° *or* 180°) *(Giza 2017)*

6 A box contains 4 white balls and 6 red balls, all are identical. One ball is drawn randomly. Find the probability that the drawn ball is:

a) white b) red c) green *(Cairo 2019)*

7 A basket contains 15 balls numbered from 1 to 15, a ball is drawn randomly, find the probability of:

a) The drawing ball carries a prime number.

b) The drawing ball carries a number divisible by 5 *(Demietta 2016)*

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8 ***The following table shows the rate of the score of 200 students in one school of Cairo Governorate:***

Rate	Excellent	Good	Pass	Weak
Percentage	15%	50%	25%	10%

Represent these data by a pie chart. *(Sohag 2019)*

9 ***We asked students in a classroom for their favourite TV programmes and the result was as follows:***

Kinds of the programmes	Musical	Cultural	Sporting
The percentage	15%	25%	

Complete the table, then represent these data by using the circular sectors.
(Menofia 2016)

10 The following table shows the percentage of production of one factory producing 4 kinds of electric sets:

Kinds of the sets	TV	Washing machine	Heater	Oven
The percentage of production	35%	25%	15%	25%

Represent these data by using the circular sectors. *(Kafr El-Sheikh 2014)*

11 ***In the opposite figure:***

A box has 9 symmetric cards numbered from 10 to 90, they are mixed and one card is chosen randomly. Find the probability of the events:

a) A number divisible by 5

b) A number divisible by 3

c) An odd number.

50	40	20
60	30	10
70	80	90

(Qalubia 2016)

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Unit Test 4
(From the School Book)
on Unit

Total mark / 30

1 The following table shows the percentage of the favourite sports for your class students: / 6

The favourite sport	Football	Basketball	Volleyball	Swimming	Ping-pong
The percentage	45%	9%	24%	10%	12%

Represent the previous data by using the circular sectors.

2 In a meeting for discussing the problems of the workers in a factory, 100 workers (men and women) were attending. If the probability of choosing a man to stand and discuss the problems of the workers is $\frac{3}{5}$, calculate the number of the men and women in this meeting. / 6

3 In one of the classes of the sixth primary, the teacher of maths classified the levels of the students whose number is 40 in his subject into (weak - intermediate - advanced), and recorded these data in the opposite table: / 6

The level	Number of the students
Weak	5
Intermediate	25
Advanced	10
Sum	40

If one of the students in this class is chosen at random. Calculate the probability of:

a) Event A where A is a weak student.

b) Event B where B is an advanced student.

c) Event C where C is not an intermediate student.

4 A fair die is tossed once, and the number of dots on the upper face is observed. Calculate the probability of: / 6

a) Event A where A is the appearance of a number less than 4

b) Event B where B is the appearance of a number that satisfies the inequality $1 < B < 6$

5 A class of 40 students has taken a maths exam, whose full mark is 50: If 30 students got less than 40, and 10 students got (40 up to 50), calculate the probability of: / 6

a) Event A where A is the event that a student got less than 40 marks.

b) Event B where B is the event that a student got a mark that satisfies the inequality $B \geqslant 40$

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TIMSS QUESTIONS
(Basic Cumulative Skills)

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TIMSS QUESTIONS

1 Assuming that today is Tuesday, then what day will it be after 100 days from now?

2 Find the sum of numbers from 1 to 25. In another word if S = 1 + 2 + 3 + ... + 25
Find the value of S.

3 In a stationery, the price of a pen differs from the price of a pencil. The price of three pens and two pencils is 78 pounds, but the price of 3 pencils and 2 pens is 72 pounds. What is the price of the pencil?

4 A team consists of 3 members need 3 weeks and two days to achieve specific work. How long time will take a team of 4 members to do the same work if each member in each team works with the same rate?
Note: a week has 6 working days.

5 Alaa and Shimaa have got the same amount of money. If Alaa spent 27 pounds and Shimaa spent 12 pounds, then the ratio between what Alaa and Shimaa have become 2 : 5, how much money was with Alaa at the beginning?

6 A girl bought a dog for 100 pounds, then she sold it for 150 pounds. Once again she bought the same dog for 200 pounds, then she sold it for 250. pounds. Do you think the girl lost or gained and how much?

7 30 coins of 5 piastres and 25 piastres. If the total value of the 30 coins is 4.10 pounds, how many coins of each of 5 piastres and 25 piastres?

8 Rectangular cards with dimensions 2 inches and 3 inches was cut from a rectangular sheet with dimensions of 2 feet and 3 feet. How many cards can be cut from the sheet?
Note: one feet = 12 inches

9 In three matches of bowling pin shooting Sarah scored 139, 143 and 144 points. How many points does Sarah need to score in the fourth match to reach the average of 145 points in 4 matches?

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10 A book consists of 500 pages, numbered by 1 , 2 , 3 and so on till 500.
How many times does number 1 occur?

11 Leila spent $\frac{3}{8}$ of her money to buy a pen and half the rest to buy a box for the pens. What is the fraction of the money spent on purchasing the pen and the box?

12 A set of biscuit pieces can be evenly distributed among 2 , 3 , 4 , 5 or 6 children without keeping a piece. What is the least number of pieces of biscuit can be contained in a set?

13 A passenger covered a distance of 60 km with a rate of 20 km per hour. On the way back his rate was 30 km per hour. What is the average rate in the whole trip?

14 Calculate the sum in its simplest form:

$\frac{1}{1\times2}+\frac{1}{2\times3}+\frac{1}{3\times4}+\frac{1}{4\times5}+\frac{1}{5\times6}=$

15 What is the 100^{th} term in the pattern?

1 , 4 , 7 , 10 , ...

16 The ratio of boys to girls in the community activity in mathematics at the beginning was 1 : 2. If 9 boys joined the community, then the ratio became 2 : 1.
What is the final total number of students?

17 100 kg of chocolate is loaded or packed in several boxes. Each box weighs 1.25 kg. The price of one box is 175 pounds.
What is the cost of all the boxes of chocolate?

18 Hussien cuts 600 square yards of weed in $1\frac{1}{2}$ hrs. How many minutes will Hussien take to cut 600 square feet of weed by the same rate?
Note: 1 yard = 3 feet (check the note)

weed عشبة ضارة

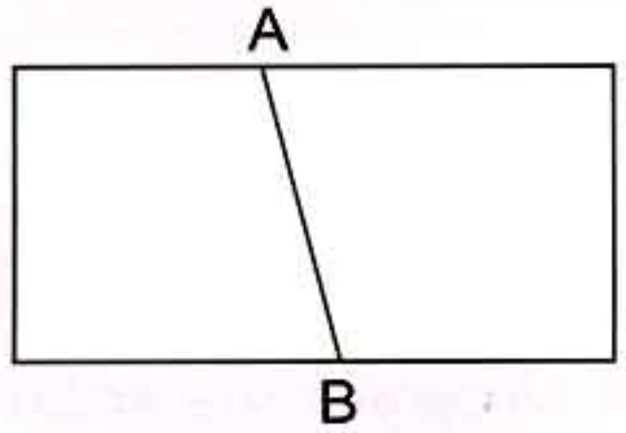
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19 In the following multiplication operation A and B represents two numbers.

Find these two numbers:

$$\begin{array}{r} B\ A \\ \times\ A\ B \\ \hline 6\ 6\ 4 \\ 2\ 4\ 9\ \\ \hline 3\ 1\ 5\ 4 \end{array}$$

20 In the opposite drawn rectangle, the line segment AB cuts the rectangle into two parts. What is the greatest number of parts that can be obtained when drawing 4 line segments?



21 If χ and y are two numbers where $\chi * y$ means $\frac{\chi + y}{2}$.

What's the value of $3*(6*8)$?

22 The ratio between what Salwa saved to what Gaber saved is 3 : 2 . If Gaber spent $\frac{1}{4}$ of what he saved, and his savings became less than Salwa's by 90 pounds. How much did Salwa save?

23 If the sum of 5 consecutive even numbers is 320, then what is the smallest number of these even numbers?

24 Simplify the following fraction to the simplest form.

$$\cfrac{1}{\cfrac{1}{\cfrac{1}{\frac{1}{2}+2}+2}+2}$$

25 There are many numbers that divide 109 with a remainder 4, write a list of the two-digit numbers that have this specification.

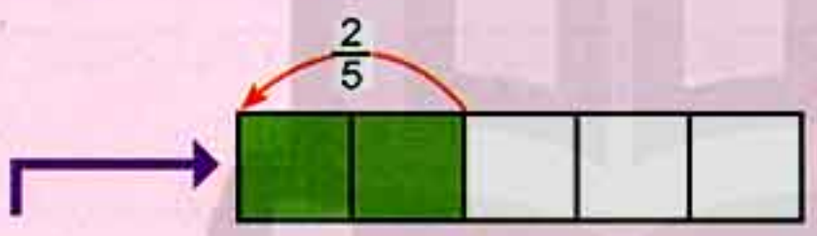
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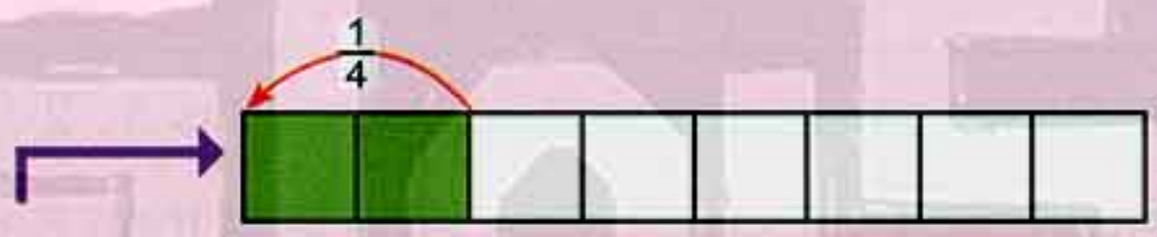
26 1AA3 is a number of 4 digits that can be divided by 9. What is the value of A?

27 A trader distributes toys. He put balls in some boxes. If there are two types of boxes, the first box can hold 5 balls, while the other one can hold 12 balls. If the trader puts 99 balls in more than 10 boxes, how many boxes did he use from each type?

28 In a city there are 403 workers in a factory. If $\frac{2}{5}$ of the men's workers and $\frac{1}{4}$ of the women's workers are not from the city and their numbers are the same, then what is the number of women in the factory who live in the same city?

A tip for the solution:

Men  = 5 parts.

Women  = 8 parts.

5 parts + 8 parts = 403

∴ 13 parts = 403

∴ The value of one part = $\frac{403}{13}$ = 31

..... complete.

Information from UNICEF



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Summary of the properties for solving the 1st degree inequalities

(without using the substitution set)

Add (or subtract) from each side of the inequality a constant positive or negative number	Multiply (or divide) each side of the inequality by a constant positive number only	Multiply (or divide) each side of the inequality by a constant negative number only
You can add to (or subtract from) each side of the inequality without changing its direction.	You can multiply (or divide) each side of the inequality without changing its direction.	If you multiply (or divide) each side of the inequality by a negative number, then its direction must be changed.
For example: 1 If $x - 5 < 2$ $\therefore x - 5 + 5 < 2 + 5$ $\therefore x < 7$ **For example:** 2 If $x + 5 < 2$ $\therefore x + 5 - 5 < 2 - 5$ $\therefore x < -3$	**For example:** 1 If $\frac{x}{2} < 4$ $\therefore 2 \times \frac{x}{2} < 4 \times 2$ $\therefore x < 8$ **For example:** 2 If $3x < 6$ $\therefore \frac{3x}{3} < \frac{6}{3}$ $\therefore x < 2$	**For example:** 1 If $-\frac{x}{2} < 4$ $\therefore -2 \times \frac{-x}{2} > -2 \times 4$ $\therefore x > -8$ **For example:** 2 If $-3x < 6$ $\therefore \frac{-3x}{-3} > \frac{6}{-3}$ $\therefore x > -2$



Information from UNICEF

Every day I eat fruits which protect me from diseases.

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Unit (1)

Worksheet 1 on Lesson (1) - Unit (1)

Total mark / 25

1 Choose the correct answer: / 5

a) $\left|\frac{1}{3}\right| - \left|\frac{-1}{3}\right|$ $\mathbb{Z}$ ($\in$ or $\notin$ or $\subset$ or $\not\subset$)

b) If $x = |-5|$, then x = ... (–5 or 5 or 0 or 10)

c) $\mathbb{Z}^+ \cap \mathbb{Z}^-$ = ... ($\mathbb{Z}$ or $\mathbb{Z}^+$ or $\mathbb{Z}^-$ or $\varnothing$)

d) $\mathbb{N} \cup \mathbb{Z}$ = ... ($\mathbb{Z}$ or $\mathbb{N}$ or $\mathbb{Z}^-$ or $\mathbb{Z}^+$)

e) $\mathbb{Z}^+ - \mathbb{Z}^-$ = ... ($\mathbb{Z}^+$ or $\varnothing$ or $\mathbb{N}$ or $\{0\}$)

2 Complete each of the following: / 5

a) The complement of $\mathbb{Z}^-$ with respect to $\mathbb{Z}$ is

b) $|-3| + |-2|$ = ...

c) $\{15\}$ $\mathbb{Z}^-$

d) If $X \subset \{2 , -3\} \cap \{5 , -3\}$, then X = ... or

e) $\frac{|-6| + 2}{2}$ =

3 Represent each of the following on the number line: / 5

a) –3 , 0 , 2 , 1 , –6 , 5

b) 6 , –3 , 0 , –1 , 3 , 5

4 Find each of the following: / 5

a) $|-4| \times |7|$ b) $|-30| \div |-5|$

5 Find the value of x to get a true statement: / 5

a) $-5 \in \{-1 , 0 , -3 , x\}$

b) $|-7| \notin \{ x , -7, 3\}$

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Worksheet 2 — Till Lesson (2) - Unit (1)

Total mark / 25

1 Complete each of the following: (..... / 5)

a) The previous integer and the next integer of - 40 are and

b) If $x = |-7|$, then x = ...

c) If $|x| = 15$, then x = ... or

d) $3 + |-3|$ $|-10|$ (Put < or > or =)

e) $|-3| - |-5| + 2$ = ...

2 Choose the correct answer: (..... / 5)

a) $\mathbb{Z} - \mathbb{N}$ = ... ($\mathbb{Z}^-$ or $\{0\}$ or $\mathbb{Z}^+$ or 0)

b) The smallest positive integer is (1 or –1 or $\varnothing$ or zero)

c) The number of integers between –2 and 4 is (3 or 4 or 5 or 6)

d) $|-9| + 3$ $\mathbb{Z}$ ($\in$ or $\notin$ or $\subset$ or $\not\subset$)

e) If $a \in \{2, -5, -3\} \cap \{-2, 5, -3\}$, then a = ... (– 5 or –3 or 20 or 3)

3 Arrange each of the following in descending order: (..... / 5)

(1) $|-2|$, 3, 4, –2 and zero

(2) –3, zero, $|-2|$, 5 and $|-7|$

4 Represent the following sets on the number line: (..... / 5)

(1) The set of integers less than 4

(2) The set of integers greater than –3 and less than 4

5 Find the value of x in each of the following: (..... / 5)

(1) $|-2| + |3| = x$

(2) $|x| = 3 + |-5|$

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Worksheet 3 — Till Lesson (3) - Unit (1)

Total mark / 25

1 Complete each of the following: (..... / 3)

a) 8 + (–11) = ...

b) (–7) + (–4)

c) The greatest negative integer = ...

d) $-|7| + |-5|$ = ...

e) 23 – (–13) = ...

f) The set of odd integers ∪ the set of even integers = ...

2 Choose the correct answer: (..... / 3)

a) $\left|\frac{7-11}{2}\right|$ = ... (1 *or* 0 *or* 2 *or* –2)

b) –4 – (–6) 0 (> *or* < *or* = *or* ≤)

c) $\mathbb{Z}^+ \cap \mathbb{Z}^-$ = ... (∅ *or* {0} *or* $\mathbb{Z}$ *or* $\mathbb{Z}$ – {0})

d) $\mathbb{Z} - \mathbb{Z}^-$ = ... ($\mathbb{Z}^-$ *or* $\mathbb{Z}^+$ *or* $\mathbb{N}$ *or* {0})

e) |– 5| + ... = zero (–5 *or* 5 *or* Zero *or* 1)

f) If a = 3, b = –7, then the value a + b = ... (3 *or* 4 *or* –4 *or* 5)

3 a) Use the properties of addition in $\mathbb{Z}$ to get the result of the following: (..... / 7)

(1) (–240) + 34 + 140

(2) 1035 + 75 + (–1000)

b) Check the closure property in addition and subtraction on the set X = {–2, 0, 2}

4 a) Complete each of the following: (..... / 6)

(1) The additive inverse of 7 is

(2) The additive identity element in $\mathbb{Z}$ is.....

b) If a = 4, b = –2 and c = –5, find:

(1) a – (b – c)

(2) (b + c) – a

5 Use the number line to find the sum of each of the following: (..... / 6)

a) 3 + 2 **b)** (– 3) + 4 **c)** 3 + (–7)

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Worksheet 4 — Till Lesson (4) - Unit (1)

Total mark / 25

1 Choose the correct answer: / 3

a) $-|9| + |-3|$ = ... (–3 *or* –9 *or* –6 *or* 6)

b) $-8 \div (-4)$ = ... (2 *or* 4 *or* –2 *or* zero)

c) The additive inverse of the number $|-3|$ = ... (3 *or* –3 *or* 6 *or* zero)

d) -7×-9 = ... (63 *or* –2 *or* –72 *or* 72)

e) $7 \times (6 + (-3))$ = ... (–1 *or* 16 *or* 10 *or* 21)

f) If $a \in \{-2, -5, -3\} - \{-2, 5, -3\}$, then a = ... (–5 *or* –3 *or* 2 *or* 3)

2 Complete the following: / 5

a) $\mathbb{Z} \cup \{0\}$ = ...

b) $|-36| \div |-4|$ = ...

c) If $x \times (-5) = 45$, then x = ...

d) $(35 \div 5) \div (-7)$ = ...

e) $5 \times (-3 + 7)$ = ...

3 a) Find the numerical value of: / 5

$2x + y - Z$ if $x = 3$, $y = -1$, $Z = -7$

b) **Find the result of the following:** $(5 + (-3)) \times -11$

4 Find the result of each of the following: / 6

1) $420 \div (-15)$ 2) $(-1300) \times 2$ 3) $15 \times (-15)$

4) $112 + 75 + (-112)$ 5) $(-144) \div 12$ 6) (Zero $\times$ 7) $\div$ (–12)

5 Find the value of x in each of the following: / 6

a) $x = (-2) \times 5$ b) $3 \times x = -24$

c) $(-48) \div x = (-4)$ d) $5 \times |-7| = 5 \times |x + 1|$

e) $-4x = 36$ f) $x \times (7 \times 8) = [(-9) \times 7] \times 8$

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Worksheet 5 — Till Lesson (5) - Unit (1)

Total mark/25

1 Complete the following: (...../3)

a) $(-5)^2 + (-2)^3 =$

b) $[(-2)^5 \times (-2)^4] \div (-2)^8 =$

c) $(-6)^5 \div (-6)^3 =$

d) $\mathbb{Z}^- \cup \mathbb{Z}^+ =$

e) $\mathbb{Z} - \mathbb{N} =$

f) The complement of $\mathbb{N}$ relative to $\mathbb{Z}$ is

2 Put the suitable sign (<, = or >) in each of the following: (...../3)

a) 4^2 16

b) $(-5)^2$ (-10)

c) $\frac{1}{3^5} \times 3^5$ $(75)^{Zero}$

d) $(9)^2$ 18

e) $2^{11} \div 2^9$ 2^2

f) $(-4)^2 \times 3^2$ $(12)^3$

3 a) Arrange the following descendingly: (...../8)

10^5 , $(-1)^7$, 100^2 , $(-10)^3$ and 1 000 000

b) Find the value of:

1) $\frac{3^4 \times (-3)^5}{3^7}$

2) $\frac{(-8)^7 \times (-8)^3}{(-8)^9}$

4 a) Check the closure property in addition and subtraction on (...../5)

the set X = {–3, 7, 3, –1}

b) The temperature on Tuesday in the morning in Cairo was 32°C while at night it dropped to 18°C. Calculate the decrease in the temperature.

5 a) Simplify each of the following to the simplest form: (...../6)

1) $\frac{x^9}{x^3 \times x^2}$, where $(x \neq 0)$

2) $\frac{a^{12}}{a^7 \times a^2}$, where $(a \neq 0)$

b) If a = – 2 , b = –1 and c = 3, find the value of:

1) $a^2 + b^2$

2) $(a + b)^3$

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Worksheet 6 — Till Lesson (6) - Unit (1)

Total mark / 25

1 Complete in the same pattern: / 5

a) 7,10,13 , ... , ...

b) –15 , –12 , –9, ... , ...

c) – 2 , – 4 , –6 , –8 , ... , ...

d) 16 , 12 , 8 , 4, ... , ...

e) $\frac{1}{3}$, $\frac{2}{3}$, 1 , $\frac{4}{3}$, ... , ...

2 Choose the correct answer: / 5

a) If x = 1, y = –2, then the negative number in the following is
($x + y^2$ or $x^2 - y$ or $x^2 + y$ or $x^2 + y^2$)

b) [8 + (–3)] × (–3) = ...
(15 or –15 or 72 or –72)

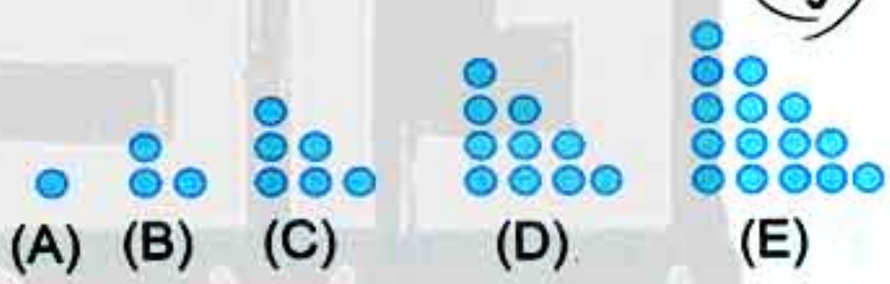
c) 4 + (–6) >
(2 or 0 or –2 or – 4)

d) –7 – |–9|
(> or = or < or ≤)

e) $(-1)^3 - 1$ = ...
(– 2 or 0 or 1 or 2)

3 Write the number of dots below to each figure of the following: / 5

	(A)	(B)	(C)	(D)	(E)
Number of dots:					
The numerical pattern:					
The rule of the pattern:					



4 Complete the following table: / 5

The numerical pattern	Description of the pattern
3 , 7 , 11 , 15 , 19 , 23 , ...	
.....	Each number is more than its preceding by 5
$\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, 1 , $\frac{5}{4}$, ...	
.....	Each number is less than its preceding by 4
3 , 9 , 27 , 81 , ...	

5 Khaled decided to lose weight at the rate of 3 kg monthly. If he is 90 kg right now, then how many months does he need to reach 69 kg? / 5

- Write the rule expressing the numerical pattern and describe it.

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Unit 1 — Test (1) — Total mark / 30

..... / 5

1 Choose the correct answer:

a) –2 ℕ (⊂ or ⊄ or ∈ or ∉)

b) ℤ – {0} = ℤ⁺ ℤ⁻ (∩ or ⊂ or ∪ or ⊄)

c) $(-1)^3 + 1$ = ... (–2 or 0 or 1 or 2)

d) An integer number included between –2 and 3 is (3 or – 3 or – 4 or –1)

e) ℤ⁺ – ℤ⁻ = ... (∅ or ℕ or ℕ – {0} or ℤ)

2 Complete the following:

..... / 5

a) If $x = |-2|$, then x = ...

b) [9 + (– 5)] × –2 = ...

c) $\frac{1}{3}, \frac{1}{6}, \frac{1}{12}, \frac{1}{24}$, ... (in the same pattern)

d) The natural number just after the natural number $(x + 1)$ is

e) 𝔼 ∩ ℙ = ...

3 Arrange the following numbers descendingly: –3 , 3 , 2 , –2 , |–1|

The order is:, ..., ..., ... and

..... / 2

4 Use the properties of addition and multiplication operations in ℤ to find each of the following:

..... / 9

a) – 25 + 58 + 25 b) (– 6) × [(–3) – 2] c) 40 × 14 × 25

.....

.....

5 Find the result of each of the following:

..... / 9

a) (– 98) ÷ (–2) b) $4^3 \times (-2)^2 \div 16$ c) $\frac{(-5)^2 \times (5)^2}{(-5)^3}$

.....

.....

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Unit 1 **Test (2)** **Total mark** / 30

1 Complete the following: / 5

a) The smallest non-negative integer is

b) $2^3 + 2^2$ = ...

c) If a = 3, b = –2, then the value of 3ab = ...

d) If b is the additive inverse of a, then a + ... = 0

e) (4^3) is called to the power of

2 Choose the correct answer: / 5

a) If F is an odd number, then the even number from the following is
(F^2 *or* $F^2 + F$ *or* $2F + 1$ *or* F^3)

b) If (a + b) = zero, a ≠ b, then a × b zero.
(< *or* > *or* = *or* ≤)

c) $\mathbb{Z}^-$ $\mathbb{N}$
($\in$ *or* $\notin$ *or* $\subset$ *or* $\not\subset$)

d) The multiplicative identity in $\mathbb{Z}$ is
(–1 *or* 0 *or* 1 *or* 5)

e) 1 , 1 , 2 , 3 , 5 , 8 , ...
(8 *or* 13 *or* 10 *or* 5)

3 Use the distribution property to calculate the value of each of the following: / 6

a) $(18)^3 + 18 \times 83 - 18$ b) $(-14) \times 99$

4 If x = 5 , y = –2 and z = –3, calculate the value of each of the following: / 7

a) $x\,y + x\,z$ b) $\frac{x^2}{y + z}$

5 Find the result of: / 7

a) $\frac{2^{11}}{2^3 \times 2^6}$ b) 63 + 54 + 37 + 46 (State the used property.)

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Unit (2)

Worksheet 7 — On Lesson (1) - Unit (2)

Total mark / 25

1 Choose the correct answer: / 5

a) The degree of the equation: $x^3 + 2x^2 = -4$ is (1st or 2nd or 3rd or 4th)

b) $8 + |-8|$ = ... (8 or –8 or zero or 16)

c) The solution set of the equation $2x - 3 = 1$ is if the substitution set is $\{0, 1, 2, 3\}$. ({0} or {1} or {2} or {3})

d) The degree of the equation $x + 1 = 2$ is (1 or 2 or 3 or 4)

e) Which of the following represents an equation?

($x - 17$ or $22 - 7$ or $x > -11$ or $2x + 3 = 7$)

2 Complete the following: / 5

a) 3, 9, 27, 81, ... , ... (in the same pattern).

b) If $x = 2$, $y = 3$, then the value of $2xy$ = ...

c) If the substitution set is {0, 1, 2, 3, 4}, then the solution set of the inequality $x + 2 < 5$ is

d) The degree of the equation: $2x^2 - x - 5$ = zero is

3 a) Find the result of each of the following using the properties of addition and multiplication: / 5

1) $6 \times ((-2) + (-7))$ **2)** $(-25) + 39 + 25$

b) Find the value of: $4 \times (-16) \times 25$ (Without using the calculator)

4 If the substitution set is {–4, –2, 0, 2}, find the S.S. of each of the following: / 6

1) $2x + 1 = 5$ **3)** $2 + 3x = 7$

2) $2x + 5 \geq 3$ **4)** $4x - 3 = 9$

5 Complete in the same pattern: / 4

a) – 24, – 22, – 20, ..., ..., ...

b) $\frac{1}{3}$, $\frac{2}{3}$, 1, $\frac{4}{3}$, ..., ..., ...

c) 0 , 1, 8, 27 , 64, ..., ..., ...

d) 0 , 1 , 4, 9 , ..., ..., ...

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Worksheet 8 — Till Lesson (2) - Unit (2)

Total mark / 25

1 Complete each of the following: / 5

a) The degree of the equation $2^3 + x = 10$ is

b) If $2x = 8$, then $3x =$

c) The solution set of the equation $2x = -10$ in $\mathbb{N}$ = ...

d) The solution set of the inequality $x + 3 \leq 7$ if the substitution set is $\{3, 4, 5, 6\}$ is

e) If $x + 2 = -2$, then $x =$

2 Find the solution set of the following equations in $\mathbb{Z}$: / 6

a) $4x - 2 = 3x + 8$

b) $3x - 2 = x - 13$

c) $2x + 5 = -5$

3 Study the possibility of solving the following equations in $\mathbb{N}$ and $\mathbb{Z}$: / 4

a) $3m + 12 = 6$

b) $12 + 5x = 27$

c) $\frac{3}{5}x = -6$

d) $3x - 8 = 4x - 6$

4 a) Find the solution set of the inequality: / 5

$2x + 5 > 2$, if the substitution set is $\{-3, -2, -1, 0, 1\}$.

b) What's the number which if added to its three times, the result is 64?

5 Find the result of the following: / 5

a) $\frac{(3)^6}{(3)^3} + \frac{(-2)^5}{(-2)^4}$

b) $3 \times -5 - (2 \times 3)^2 \div 4$

c) $[5 + (-3)] \times (-11)$

d) $4^2 + 4^2 + 4^2 + 4^2$

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Worksheet 9 — Till Lesson (3) - Unit (2)

Total mark / 25

1 Choose the correct answer: / 5

a) If $x > y$, then $x - z$ $y - z$ ($<$ *or* $>$ *or* $=$ *or* $\leq$)

b) The number which verifies the inequality $x - 1 > 2$ is (6 *or* 3 *or* 1 *or* zero)

c) If $x < y$ and z is negative, then xz yz ($<$ *or* $>$ *or* $=$ *or* $\geq$)

d) All the following numbers verify the inequality $x > -5$ except
(– 6 *or* – 4 *or* – 3 *or* – 2)

e) The S.S. of the inequality $-3x < 0$ in $\mathbb{Z}$ is ($\varnothing$ *or* $\mathbb{Z}$ *or* $\mathbb{Z}^+$ *or* $\mathbb{N}$)

2 Complete the following: / 5

a) If $x - 3 > 2$, then $x >$

b) If $y - 1 < 0$ then $<$

c) The S.S. of the inequality $-3 < x \leq 0$ in $\mathbb{Z}$ is

d) If $|x| + 9 = 12$, then $x =$

e) If $\frac{x}{2} = 5$, then $x =$

3 Solve the following equations in $\mathbb{Z}$: / 5

1) $x + 2 = 3x + 8$

2) $3x + 5 = 14$

4 Solve the following inequality and represent the solution set on the number line: / 5

1) $3x + 4 \leq 10$, $x \in \mathbb{Z}$

2) $2(x - 1) > 4$, $x \in \mathbb{Z}$

5 Let the substitution set M = {0, 1, 2, 3}, find: / 5

1) The solution set of the equation: $2x - 7 = -1$

2) The solution set of the inequality: $x + 4 > 5$

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Unit 2 **Test (1)** Total mark/30

1 Complete the following: (...../4)

a) If $(x + 1)$ is the additive inverse of (-2), then $x =$

b) $x^2 + 3 = 8$ is an equation of the degree.

c) The set of integers smaller than 3 is

d) $\mathbb{Z}^+ \cap \mathbb{Z}^- =$

e) $2^6 \times 2^2 \times 2^7 =$

2 Choose the correct answer: (...../5)

a) All the following numbers satisfy the inequality: $x > -3$ except

(0 *or* –1 *or* – 2 *or* – 4)

b) The solution set of the equation: $7x = -42$ in $\mathbb{Z}$ is

({7} *or* {–7} *or* {6} *or* {– 6})

c) The solution set of the inequality: $2x + 5 > 3$ is ($\mathbb{N}$ *or* $\mathbb{N} - \{0\}$ *or* $\mathbb{Z}^+$ *or* $\mathbb{Z}^-$)

d) If zero $\in \{5 , x - 3\}$, then $x =$ (zero *or* –5 *or* 3 *or* –3)

e) $2^5 \div 2^5 = 3^{.....}$ (2 *or* 10 *or* zero *or* 1)

3 Find the solution set of the following: (...../7)

a) $3x - 2 < 7$ (where $x \in \mathbb{N}$)

b) $3 - 2x = 9$ (where $x \in \mathbb{Z}$)

c) $3x - 5 \leq 7$ (where $x \in \mathbb{Z}^+$)

4 Find the result of the following: (...../7)

$$\frac{(-3)^6}{(-3)^3} + \frac{(-4)^5}{(-4)^3}$$

5 If $3x \times [7 - (-2)] = (-3) \times (-3)$, **find** the value of x (indicating the steps of the solution). (...../7)

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Unit 2 **Test (2)** **Total mark** / 30

1 Complete the following: / 5

a) The additive neutral element in $\mathbb{Z}$ is, while the multiplicative neutral element in $\mathbb{Z}$ is

b) The solution set of $2x - 1 = -1$ is, if the substitution set is $\{0, 1, 2, 3\}$

c) If $\frac{x}{5} = 4$, then S.S. in $\mathbb{N}$ is

d) Two successive odd natural numbers, if the smaller is 9, then the greater is

e) The distance between the location of an integer and location of zero on the number line is called

2 Choose the correct answer: / 5

a) Which of the following represents inequality?

($x - 17$ or $22 - 7 \neq 15$ or $x > -11$ or $2x + 3 = 7$)

b) If $x + 3 = 8$, $x \in \mathbb{Z}^-$, then the solution set is

($\{-3\}$ or $\{5\}$ or $\{-5\}$ or $\varnothing$)

c) $|-9|$ $\mathbb{Z}^+$

($\subset$ or $\not\subset$ or $\in$ or $\notin$)

d) The number which if added to its double, the result is 9 is

(2 or 3 or 4 or 5)

e) $3^7 \div 3^7 =$

(zero or 1 or 3 or 7)

3 Find the solution set of the equation: $6x + 2 = 14$, $(x \in \mathbb{Z})$ / 6

4 Find the result of: $\frac{(3)^4 \times (-3)^5}{(-3)^7}$ / 7

5 Using the properties of addition in $\mathbb{Z}$, find the result of the following in the simplest form $-15 + 29 + 15$. (State the used property.) / 7

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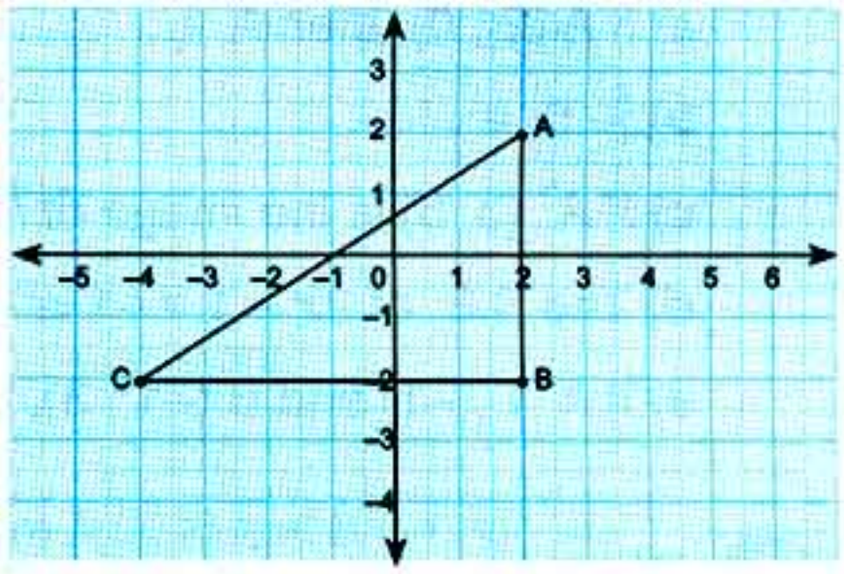
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Unit (3)

Worksheet 10 On Lesson (1) - Unit (3)

Total mark / 25

1 ***In the opposite coordinate plane: complete:*** / 5



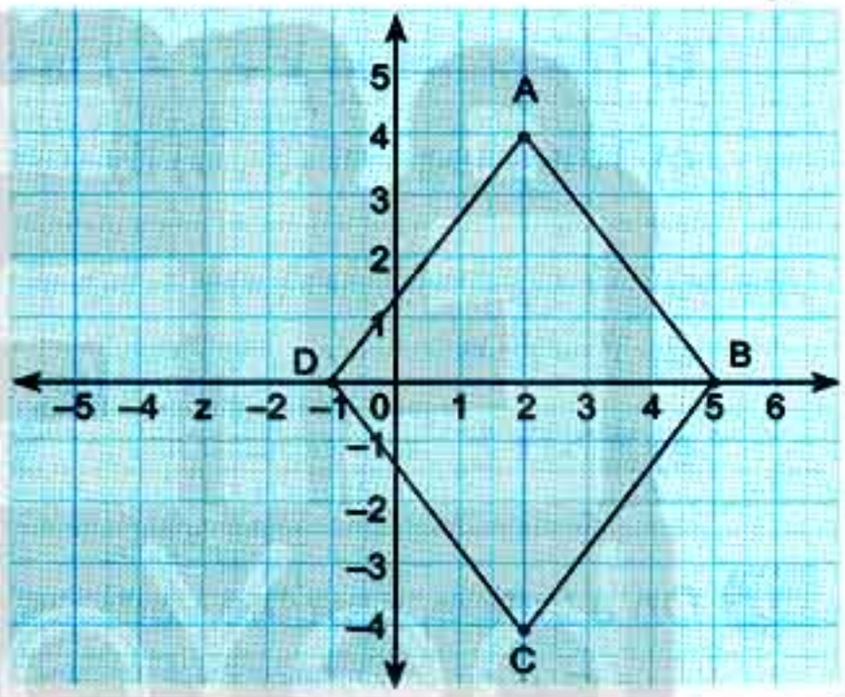
a) A (..... , ...) , B (..... , ...) ,
C (..... , ...)

b) The length of $\overline{BC}$ = ...

c) The length of $\overline{BA}$ = ...

d) The type of the triangle ABC with respect to its angles is

2 ***In the opposite figure: complete:*** / 4



a) A (..... , ...) , B (..... , ...) ,
C (..... , ...) , D (..... , ...)

b) The length of $\overline{AC}$ = ...

c) The length of $\overline{BD}$ = ...

d) The surface area of the figure ABCD = ...

3 a) **Find** the S.S. of $3x + 2 = x + 18$ in $\mathbb{Z}$ / 6

b) **Use the properties of addition in $\mathbb{Z}$ to find the result of**
$112 \times 17 + 112 \times (-17)$. **(State the property that you use.)**

4 a) If $x = 8$, $y = -2$, **find the value** of $x - 2y + 4$ / 6

b) **Arrange in ascending order:** 3 , –30 , $|-30|$, zero and -3×3

c) **Find** the solution set of $2x - 5 \leq 7$ in $\mathbb{Z}$.

5 On the coordinate plane, determine the points A (5, 1), B (5, –3), C (–3, –3) and D (–3 ,1), then **find**: / 4

1) The length of $\overline{AB}$ and $\overline{AD}$.

2) The surface area and the perimeter of ABCD.

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Worksheet 11 Till Lesson (2) - Unit (3)

Total mark/25

1 Complete the following: (...../5)

a) If A (2 , 0), then A` (.... , ...) is its image by translation (2 , 3).

b) |– 5| = ...

c) If A` (3, 5) is the image of A by translation (2,1), then the coordinate of A is (.... , ...).

d) The S.S. of $2x - 1 = -1$ is if the substitution set is {0 , 1 , 2 , 3}

e) If A (1 , –1) and B (–1 , 3), then the translation that makes B the image of A is

2 Choose the correct answer: (...../5)

a) The image of the point A (5 , 3) by translation (–4 , 1) is

((1 , 4) *or* (–1 , –4) *or* (3 , 2))

b) The equation $x + 1 = 7$ is of the degree. (1^{st} *or* 2^{nd} *or* 3^{rd} *or* 4^{th})

c) The image of (3 , 3) by translation $(x + 2 , y - 1)$ is

((–2 , 5) *or* (2 , 5) *or* (–5 , 2) *or* (5 , 2))

d) $\mathbb{Z} - \mathbb{N}$ = ... ($\mathbb{Z}^-$ *or* {0} , $\mathbb{Z}^+$ *or* zero)

e) $\mathbb{Z}^+ \cap \mathbb{Z}^-$ = ... ($\mathbb{Z}^+$ *or* $\mathbb{N}$ *or* $\emptyset$ *or* {0})

3 On a lattice, plot the vertices of the triangle ABC where A (1 , 2) , B (–2 , 2) and C (–2 , –4), then draw its image by translation $(x + 3 , y - 1)$. (...../4)

4 On the coordinate plane, determine A (2 , 3) , B (4 , –2) , C (–2 , –2), D (– 4 , 3), and E (– 4, – 2), *then find:* (...../6)

a) The length of $\overline{AD}$, $\overline{DE}$ and $\overline{BC}$.

b) The surface area of the shape ABCD and the surface area of Δ DEC.

c) The image of ABCD by translation (2 , –2).

5 a) Find the value of $\frac{(-3)^5 \times (-3)^2}{(-3)^3}$ (...../5)

b) Ahmed decided to lose weight at the rate of 4 kg monthly. If he weighs 80 kg right now, then how many months does he need to reach 56 kg? Write the rule expressing this numerical pattern and describe it.

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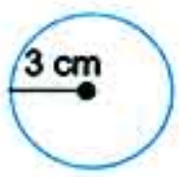
Worksheet 12 — Till Lesson (3) - Unit (3)

Total mark / 25

1 *Calculate the area of each of the following circles:* / 6

($\pi \simeq 3.14$)

a)



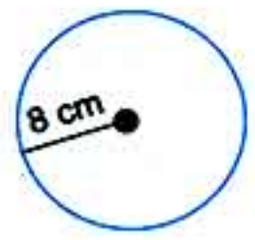
Area = ... cm^2

b)



Area = ... cm^2

c)



Area = ... cm^2

2 a) On the coordinate plane, **find the image of AB where A (2, 2) and B (–1, 4) by translation (2, –3).** / 4

b) **Find the circumference and the area of the circle** whose diameter is 28 cm. $\left(\pi \simeq \frac{22}{7}\right)$

3 *a) Calculate:* the radius length of the circle whose area is 7546 m^2. $\left(\pi \simeq \frac{22}{7}\right)$ / 6

b) Find the area of the shaded part in each of the following figures:

1)

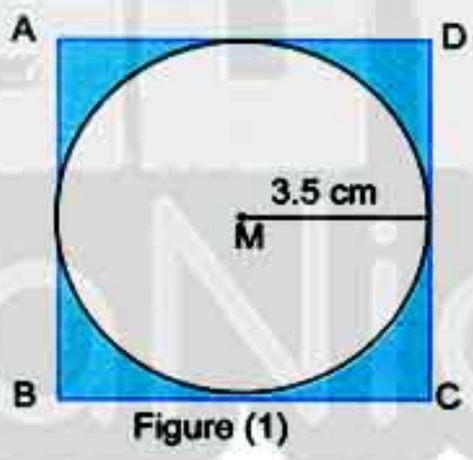


Figure (1)

2)

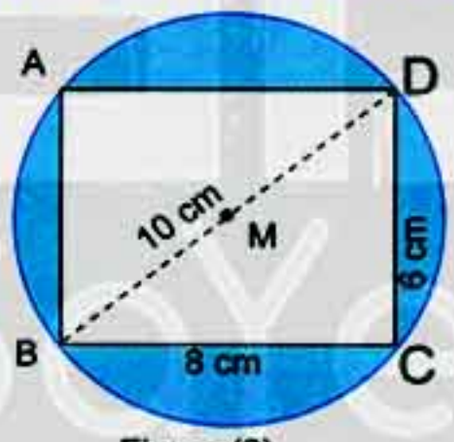


Figure (2)

4 *Solve each of the following in $\mathbb{Z}$:* / 4

a) $(4x + 3) + 8 = 31$

b) $\frac{x-3}{4} = 2$

c) $1 - 8x < 33$

d) $2x - 3 < 5$

5 a) **Calculate** the area of the circle whose circumference is 44 cm. / 5

b) **Determine** on the Cartesian coordinate the image of rectangle ABCD where A (2 , 3) , B (2 , 1), C (–2 , 1) and D (–2 , 3) by translation $(x + 3 , y + 3)$.

What is the type of the shape A`B`C`D`?

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Worksheet 13 Till Lesson (4) - Unit (3)

Total mark/25

1 Choose the correct answer:/5

a) The image of the point A (–3,1) by translation $(x + 3, y + 2)$ is

((–3,0) *or* (0,3) *or* (– 6,3) *or* (6,1))

b) The lateral area of a cube = the area of one face x (2 *or* 3 *or* 4 *or* 6)

c) The lateral area of a cuboid with the perimeter of base 10 cm and height 4 cm = ... cm^2.

(14 *or* 20 *or* 24 *or* 40)

d) The area of the circle with diameter length 20 cm = ... cm^2.

(31.4 *or* 314 *or* 1256 *or* 12.56)

e) If the perimeter of one face of a cube = 12 cm, then its total area = ... cm^2.

(53 *or* 54 *or* 55 *or* 56)

2 Complete the following:/5

a) The area of a circle with radius length 5 cm = ... π cm^2.

b) The sum of the edge lengths of a cube equals 108 cm, then the length of each edge = ... cm.

c) The cuboid whose lateral area = 120 cm^2 and the perimeter of its base is 12 cm, then its height = ... cm.

d) The image of the point (0,2) by translation $(x + 1, y + 3)$ is

e) If A (–2,7) and B (2,7), then AB = ... length units.

3 Determine the following on the Cartesian coordinate:/5

A (2, 2), B (2, –2), C (–2, –2) and D (–2, 2) and **find its image by translation.** $(x + 2, y + 1)$, **then answer the following:**

1) Mention the name of the shape. **2)** Calculate the area of this shape.

4/6

a) A cube of edge length 6 cm, **calculate its lateral area.**

b) A circle whose diameter length = 42 cm is divided into six equal circular sectors.

Find the area of each sector. $\left(\pi \simeq \frac{22}{7}\right)$

5/4

Nada used a piece of cardboard in the shape of a square with side length 25 cm to design a box in the shape of a cube with side length 50 cm.

Calculate the area of the remaining paper.

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Unit 3 — Test (1) — Total mark / 30

1 Choose the correct answer: / 5

a) The number of axes (lines) of symmetry of the square = ... (1 *or* 2 *or* 3 *or* 4)

b) The surface area of the circle = ... (π r *or* π r^2 *or* 2 π r *or* 2 π r^2)

c) The image of the point (–4 , 3) by translation (–1 , –4) is

((– 3 , –1) *or* (–7 , 3) *or* (–5 , –7) *or* (–5 , –1))

d) The lateral surface area of a cuboid whose length is 3 cm, width is 2 cm and height is 4 cm = ... cm^2. (20 *or* 24 *or* 40 *or* 52)

e) $\mathbb{Z} - \mathbb{Z}^-$ = ... ($\mathbb{Z}^+$ *or* $\mathbb{Z}^-$ *or* {0} *or* $\mathbb{N}$)

2 Complete the following: / 5

a) The area of one face of a cube is 6 cm^2, then its total area = ... cm^2.

b) The area of the square whose side length is 2 cm = ...

c) The smallest positive integer number is and the greatest negative integer number is

d) If the dimensions of the base of a cuboid are 12 cm and 8 cm and its height is 10 cm, then its lateral area = ...

e) On the coordinate plane, the image of the line segment AB where A (2, 3), B (–2, 0) by translation (x + 3, y – 2) is

3 A circle whose circumference is 62.8 cm. Find its area, where ($\pi \simeq 3.14$). / 7

4 A box without a lid in the shape of a cuboid, the inner dimensions of its base are 2 m and 3 m and its inner height is 1 m. It is wanted to cover its side faces and its floor by metallic sheets, the price of one square metre is L.E. 15. Find the price of the needed metallic sheets. / 7

5 Find the solution set in $\mathbb{Z}$ of the inequality: 1 – 8 x < 33, then represent the solution on the number line. / 6

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Unit 3 — Test (2) — Total mark / 30

1 Complete the following: / 5

a) Salam paid L.E. x for three pens, then the price of each pen is L.E.

b) The point (x , y), its image is (5 , – 4) by translation (2 , –3), then the coordinates of (x , y) = (..... , ...).

c) If the perimeter of one face of a cube equals 12 cm, then its total area = ... cm^2.

d) The circumference of a circle is 44 cm, then the radius = ... cm. $\left(\pi \simeq \frac{22}{7}\right)$.

e) A cube, its volume is 1000 cm^3 then its lateral area = ... cm^2

2 Choose the correct answer: / 5

a) The lateral area of a cuboid = the perimeter of the base X
(height *or* length *or* width *or* volume)

b) The total area of a cube = ... × 6
(edge length *or* area of one face *or* area of a triangle *or* perimeter of one face)

c) If x (–3 , 2), y (–3 , 4), then the length of $\overline{xy}$ = ... length units. (–3 *or* 2 *or* –2 *or* 4)

d) The lateral surface area of a cuboid whose length is 3 cm, width is 2 cm, and height is 4 cm = ... cm^2. (20 *or* 24 *or* 40 *or* 52)

e) If the opposite figure is a quarter of a circle whose radius length is 2 cm,



then the perimeter of the shape = ... (2π *or* 5π *or* 4π + 4 *or* π + 4)

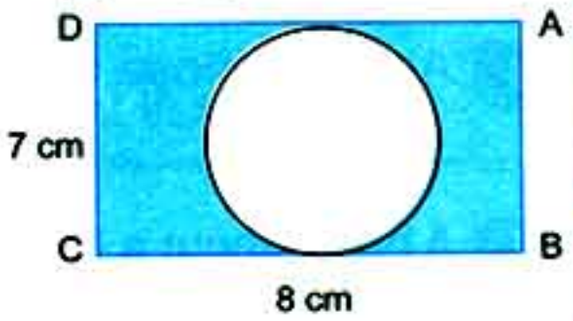
3 / 10

a) On the lattice, **determine each of the following points:** A (1 ,1) , B (3 , 1) and C (3 , 2), **then find:** 1) The length of BC.

2) The image of the triangle ABC by translation (x + 3 , y + 2).

b) In the opposite figure: ABCD is a rectangle where its length = 8 cm and its width = 7 cm.

Calculate the area of the shaded part. $\left(\pi \simeq \frac{22}{7}\right)$



4 The total area of a cube is 486 cm^2, find: / 6

1) The area of one face. 2) Its lateral area.

5 Evaluate the lateral area and total area for a tin in the shape of a cuboid of a square base whose side length is 6 cm and height is 10 cm. / 4

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Worksheet 14 On Lesson (1) - Unit (4)

Total mark/25

1 The following table shows the percentages of the time Ahmed spent studying some subjects during a week./5

Subject	Arabic	Maths	Science	English
Percentage	20%	30%	10%	40%

Represent these data by a pie chart.

2 ***Complete the following:***/5

a) In the opposite figure the measure of the central angle of food is



b) The image of the point (4, –1) by translation (x +1, y – 5) is

c) The area of the circle with diameter of length 10 cm = ... ($\pi \simeq 3.14$)

d) If the total area of a cuboid is 184 cm^2, and its lateral area is 100 cm^2, then its base area = ... cm^2.

3 **a) Find the solution set of the equation:** $2x + 1 = 8$ $(x \in \mathbb{Z})$/5

b) Find the value of: $\frac{(-1)^{15} \times (-2)^7}{(-2)^3}$

4 **a) Determine the following points on the coordinate plane:**/5

A (1, 5), B (1, 2) and C (3, 2), then determine the image of Δ ABC by translation (x + 3 , y).

b) Use the properties of addition to get the result of:

35 + (–8) + (–35) + 12

5 ***The monthly income of a family is L.E. 2400. The following table shows the percentage of its expenditure:***/5

Expenditure	Rent	Food	Transportation	Others
Percentage	25%	30%		20%

1) **Complete** the table. 2) **Represent** these data by a pie chart.

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Worksheet 15 Till Lesson (2) - Unit (4)

Total mark/25

1 Complete the following: (...../3.5)

a) is the set of all possible outcomes for a random experiment.

b) The random experiment is

c) In the random experiment of getting a number consisting of the two digits 2 and 3 the sample space is

d) The image of the point (–4,3) by translation (–1, – 4) is

e) The sample space of tossing a coin twice is

f) The measure of the central angle of the sector which is a quarter of the circle = ...°.

g) The number of integers that lie between – 2 and –4 is

2 Choose the correct answer: (...../3)

a) $|-5|$ + ... = zero (–5 or 5 or 0 or 1)

b) $\mathbb{Z} - \mathbb{Z}^-$ = ... ($\mathbb{Z}^+$ or $\mathbb{N}$ or $\varnothing$ or {0})

c) $\frac{x}{2} = 4$, then x = ... (2 or 4 or 6 or 8)

d) The cube in which the perimeter of one face = 4 cm, then its total area = ... cm^2. (3 or 4 or 5 or 6)

e) If we divide a circle into six equal sectors, then the measure of the central angle for each sector = ... (60° or 50° or 160° or 120°)

f) A circle, its diameter length is 10 cm, then its area = ... cm^2. (10 π or 5π or 25 π or 15 π)

3 Find the result of: (...../7.5)

1) $(-36) \div (-4)$ 2) $2^3 \times (-1)^2 \div 8$ 3) $\frac{(-4)^{11} \times 4^5}{4^{12}}$

4 (...../5)

a) In an experiment of tossing a die once and observing the dots on the upper face, write the sample space.



b) Find the area and the perimeter of the opposite figure. ($\pi \simeq 3.14$)



5 The following table shows the percentage of the production of 5 factories. (...../6)

Factory	First	Second	Third	Fourth	Fifth
Percentage of production	15%	10%	20%	30%	25%

Represent these data using the circular sector.

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Worksheet 16 — Till Lesson (3) - Unit (4)

Total mark / 25

1 Choose the correct answer: / 5

a) If A is an event of the sample space of a random experiment, then: $0 \leq P(A) \leq$

(0 *or* 1 *or* –1 *or* 2)

b) Which of the following values expresses the probability of an event?

(1.7 *or* – 0.7 *or* 135% *or* 27%)

c) A coin was tossed once, then the probability of getting a tail is ($\frac{1}{2}$ *or* 1 *or* $\frac{1}{3}$ *or* $\frac{1}{4}$)

d) A fair die is thrown once, then the probability of getting an integer number which verifies the inequality $4 < x < 5$ is ($\frac{1}{2}$ *or* $\frac{1}{3}$ *or* $\frac{1}{6}$ *or* Zero)

e) If P (A) = 1 then A is called event (a possible *or* an impossible *or* a certain *or* otherwise)

2 Complete the following: / 5

a) If the probability of the occurrence of an event = $\frac{3}{17}$, then the probability of non-occurrence of this event = ...

b) The sum of the measures of the accumulative angles around the centre of the circle = ...

c) The probability of choosing randomly the digit 3 from the number 9 733 354 = ...

d) A class contains 40 students, the number of girls is 25, if a student is chosen at random, then the probability that the student is a boy = ...

e) If a fair die is rolled once, then the probability of getting a number > 3 = ...

3 In an experiment of forming a 2-digit number from the set {3 , 8}, write the following in listing method: / 5

1) Event A where the unit digit is an odd number.

2) Event B where B the two digits are equal.

4 If the total area of a cube is 384 cm², then find: / 5

1) The area of one face of the cube.

2) The length of its edge.

3) Its lateral area.

5 Find the solution set of each of the following: / 5

1) $3x + 1 = 13$ if the substituting set is $\mathbb{N}$

2) $4x + 1 < 13$ if the substituting set is $\mathbb{Z}$

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Unit 4 — Test (1) — Total mark / 30

1 Complete the following: / 5

a) All outcomes of a random experiment are called

b) The measures of the angle of the circular sector which represents $\frac{1}{8}$ of the surface area of the circle = ...°

c) The sum of measures of all accumulative angles at the centre of a circle equals°

d) If ∅ is an empty set, then p (∅) = ...

e) The opposite figure represents the grades of 40 students in mathematics exam. Then the measure of the central angle for grade (very good) is



2 Choose the correct answer: / 5

a) The probability of the impossible event = ... (zero *or* 1 *or* 2 *or* ∅)

b) When tossing a die once, then the probability of getting a number divisible by 5 equals (0 *or* $\frac{1}{6}$ *or* $\frac{5}{6}$ *or* 1)

c) A box contains 4 white balls and 6 red balls. If one ball is drawn randomly, then the probability that the drawn ball is red = ... ($\frac{1}{5}$ *or* $\frac{2}{5}$ *or* $\frac{3}{5}$ *or* $\frac{4}{5}$)

d) The number which completes the pattern:

1 , 2 , 3 , 5 , 8 , 13 , 21 , 34 , ... is (47 *or* 53 *or* 55 *or* 65)

e) Which of the following can be a probability of an event?

(Zero% *or* 1.2 *or* $\frac{17}{2}$ *or* 101%)

3 A box contains 10 identical balls, numbered from 1 to 10, one ball is drawn at random. / 9

Write the sample space and then find the probability that the drawn ball has:

a) An even number. **b)** A number divisible by 5 **c)** A prime number.

4 In a competition for ideal pupils of a school, the number of boys and girls is 45. / 5

If the probability of the ideal pupil is a girl $\frac{3}{5}$, **find the number of boys.**

5 The following table shows the percentages of eggs production on three farms: / 6

a) Complete the table.

b) Represent these data by using circular sectors.

Farm	First	Second	Third
Percentage of production	25%		40%

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Unit 4 — Test (2) — Total mark / 30

1 Complete the following: / 4

a) $\mathbb{Z} - \mathbb{N}$ = ...

b) The inequality is a mathematical sentence

c) If a die is rolled once, the probability of getting an even number = ...

d) The set of prime numbers between 1 and 10 is

2 Choose the correct answer: / 4

a) $4^2 + 4^2 + 4^2 + 4^2$ = ... (4 *or* 16 *or* 64 *or* 256)

b) The measure of the angle of the circular sector of a quarter of the circle = ...
(30° *or* 45° *or* 60° *or* 90°)

c) The image of the point (3 , –2) by translation (4 , 2) is
((7 , 0) *or* (–7 , 0) *or* (–1 , 4) *or* (1 , 7))

d) A rhombus whose diagonal lengths are 6 cm and 80 cm, then its area = ... cm^2.
(48 *or* 240 *or* 420 *or* 96)

3 a) Find the result of the following: $\frac{(-2)^7 \times (-2)^5}{(-2)9}$ / 8

d) Find the solution set of the equation: $2x + 4 = -14$ (where $x \pi \mathbb{Z}$).

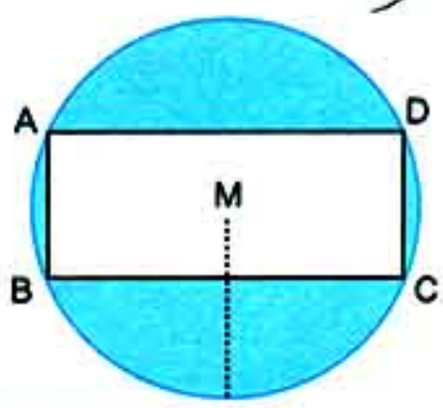
4 a) A cuboid whose length is 15 cm, its width is 5 cm and its height is 6 cm. Find: / 8

1) The lateral area 2) The total area

b) Find the solution set in $\mathbb{N}$ of the inequality: $3x - 2 < 7$

5 a) In the opposite figure: / 6

M is a circle, its radius length is 5 cm. A rectangle is drawn inside it.
Its length is 8 cm and width is 4 cm.
Find the area of the shaded part. ($\pi \simeq 3.14$)



b) The following table shows the percentage of the production of one factory for 4 kinds of electric sets.

Kinds of sets	TV	Washing machine	Refrigerator	Cooker
Percentage	35%	25%	15%	25%

Represent these data by a pie chart.

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Summary of the important rules

Unit 1

1) The set of counting numbers: $\mathbb{C} = \{1, 2, 3, ...\}$

2) The set of natural numbers: $\mathbb{N} = \{0, 1, 2, 3, ...\}$

3) The set of even numbers: $\mathbb{E} = \{0, 2, 4, 6, ..., -2, -4, -6, ...\}$

4) The set of odd numbers: $\mathbb{O} = \{1, 3, 5, ..., -1, -3, -5, ...\}$

5) The set of prime numbers: $\mathbb{P} = \{2, 3, 5, 7, 11, ...\}$

6) $\mathbb{C} \cup \{0\} = \mathbb{N}$, $\mathbb{E} \cup \mathbb{O} = \mathbb{Z}$, $\mathbb{E} \cap \mathbb{O} = \varnothing$

7) The set of positive integers $= \mathbb{Z}^+ = \{1, 2, 3, 4, ...\}$

8) The set of negative integers $= \mathbb{Z}^- = \{-1, -2, -3, -4, ...\}$

9) The set of non-negative integers $= \{0, 1, 2, 3, 4, ...\} = \mathbb{N} = \mathbb{Z}^+ \cup \{0\}$

10) The set of non-positive integers $= \mathbb{Z}^- \cup \{0\} = \{0, -1, -2, -3, -4, ...\}$

11) $\mathbb{N} - \{0\} = \mathbb{Z}^+$

12) $\mathbb{Z} = \mathbb{Z}^+ + \cup \{0\} \cup \mathbb{Z}^- = \mathbb{N} \cup \mathbb{Z}$

13) $\mathbb{Z}^+ \cap \mathbb{Z}^- = \varnothing$

14) $\mathbb{Z}^- - \mathbb{Z}^+ = \mathbb{Z}^-$ and $\mathbb{Z}^+ - \mathbb{Z}^- = \mathbb{Z}^+$

15) $\mathbb{Z} - \mathbb{Z}^- = \mathbb{N}$

16) 1 is the smallest positive integer.

17) –1 is the greatest negative integer.

18) 0 is the greatest non-positive integer.

19) $\mathbb{Z} - \{0\} = \mathbb{Z}^*$ ($\mathbb{Z}$ star) is the set of integer numbers except zero. (i.e. $\mathbb{Z}^+ \cup \mathbb{Z}^- = \mathbb{Z}^*$)

20) The absolute value of the integer (x) denoted by $|x|$ is the distance between the number (x) on the number line and the number (zero) and it is always positive or zero.

For examples:

- $|5| = 5$ it is read as absolute value of 5
- $|-5| = 5$ it is read as absolute value of –5
- $|0| = 0$ i.e. the absolute value of 0 is 0
- $|-15| \div 3 = 15 \div 3 = 5$

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21) If $|x| = a$, (a is a positive integer), then $x = a$ *or* $x = -a$.

22) If $|x| =$ zero, then $x =$ zero.

For examples:

- If $|x| = 3$ then $x = 3$ *or* $x = -3$
- If $|x| = 0$ then $x = 0$
- If $|x - 7| = 0$ then $x - 7 = 0$ then $x = 7$
- If $|2x + 8| = 0$ then $2x + 8 = 0$ then $2x = -8$ then $x = \frac{-8}{2} = -4$

23) a) $\mathbb{Z}$ is closed under addition (closure property).

For examples:

The sum of any two elements of $\mathbb{Z}$ is always an element of $\mathbb{Z}$ i.e. If $-3 \in \mathbb{Z}$ and $-1 \in \mathbb{Z}$ then $(-3) + (-1) = (-4) \in \mathbb{Z}$.

b) Commutative property: if $a \in \mathbb{Z}$, $b \in \mathbb{Z}$, then $a + b = b + a$

c) Associative property: if $a \in \mathbb{Z}$, $b \in \mathbb{Z}$, $c \in \mathbb{Z}$, then $a + b + c = (a + b) + c = a$

d) The additive identity: Zero is the additive identity (neutral): if $a \in \mathbb{Z}$, then $a + 0 = 0 + a = a$

e) The additive inverse: For each integer there is an additive inverse. If $a \in \mathbb{Z}$, then $a + (-a) = (-a) + a = 0$ **(Additive inverse of zero is zero).**

24) The properties of subtraction in $\mathbb{Z}$:

a) Subtraction in $\mathbb{Z}$ means adding its opposite i.e. $8 - 13 = 8 + (-13)$

b) Subtraction in $\mathbb{Z}$ is always possible i.e. $\mathbb{Z}$ is closed under subtraction.

c) Subtraction in $\mathbb{Z}$ is not commutative.

d) Subtraction in $\mathbb{Z}$ is not associative.

25) The properties of multiplication in $\mathbb{Z}$:

a) $\mathbb{Z}$ is closed under multiplication.

For example:

The product of any two elements of $\mathbb{Z}$ is always an element of $\mathbb{Z}$ i.e. If $-2 \in \mathbb{Z}$, $-3 \in \mathbb{Z}$ then: $(-2) \times (-3) = 6 \in \mathbb{Z}$

b) Commutative property: If $a \in \mathbb{Z}$, $b \in \mathbb{Z}$, then $a \times b = b \times a$

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c) **Associative property:** If $a \in \mathbb{Z}$, $b \in \mathbb{Z}$ and $c \in \mathbb{Z}$, then $(a \times b) \times c = a \times (b \times c)$

d) **Multiplicative identity in $\mathbb{Z}$:** One is the multiplicative identity in $\mathbb{Z}$, $a \times 1 = 1 \times a = a$

e) **Distributive property:**

Multiplication is distributed over addition and subtraction in $\mathbb{Z}$ if $a \in \mathbb{Z}$, $b \in \mathbb{Z}$ and $c \in \mathbb{Z}$, then: $a \times (b + c) = a \times b + a \times c$ and $a \times (b - c) = a \times b - a \times c$

For example:

$2 \times (-7 + 5) = 2 \times (-7) + 2 \times 5$

and $120 \times 19 + 120 \times (-19)$

$= 120 \times (19 + (-19)) = 120 \times 0 = 0$

26) *Rules of signs*

If the signs are the same		If the signs are different	
+ × +	= +	+ × −	= −
− × −	= +	− × +	= −
+ ÷ +	= +	+ ÷ −	= −
− ÷ −	= +	− ÷ +	= −

Note: Any integer multiplied by zero equals zero.

- $(-8) \times (-2) = 16$, $8 \times 2 = 16$
- $(-8) \times 2 = -16$, $8 \times (-2) = (-16)$
- $(-16) \div (-4) = 4$, $16 \div 4 = 4$
- $(-16) \div 4 = (-4)$, $16 \div (-4) = (-4)$

27) $\underbrace{a \times a \times a \times \ldots\ldots \times a}_{\text{n–times}} = a^n$ where $a \in \mathbb{Z}$, $n \in \mathbb{Z}^+$

28) If the base is a negative number raised to an even power, then the result is positive.

29) If the base is a negative number raised to an odd power, then the result is negative.

30) The first power of any number = the number itself.

31) If $a \in \mathbb{Z}$ and $m \in \mathbb{Z}^+$, $n \in \mathbb{Z}^+$ then $a^m \times a^n = a^{m+n}$

32) If $a \in \mathbb{Z} - \{0\}$, $m \in \mathbb{Z}^+$, $n \in \mathbb{Z}^+$ and $m > n$, then $\frac{a^m}{a^n} = a^{m-n}$

33) For every $a \in \mathbb{Z}$, $a \neq 0$, then $a^0 = 1$

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Unit 2

34) The mathematical sentences { Numerical sentences / Symbolic sentences }

35) The equation is a mathematical sentence that includes an equality relation between its two sides.

For example:

$2x + 3 = 1$ (equation of 1st degree),

$x^2 + 5 = 0$ (equation of 2nd degree)

36) The inequality is a mathematical sentence that includes the sign of inequality ($<, >, \leq, \geq$) between its two sides.

For examples: $x - 1 < 4, 2x + 5 > 0, 5 - 3x \leq 1$

37) **The substitution set**

It is the set of numbers which may contain the values of the unknown in the equation (or inequality).

38) **The solution set**

It is a set that contains the value (or values) of the unknown(s) which satisfies/satisfy the equation (or inequality).

39) The solution set is a subset of the substitution set and is denoted by S.S.

40) Solving equation means finding out the value(s) of the unknown symbol(s) which satisfies/satisfy the equation (to make both sides equal).

41) If a, b and c are three integers and $a = b$, then $a + c = b + c$ and $a - c = b - c$

42) If a, b and c are three integers and $a = b$, then $a \times c = b \times c$ and $a \div c = b \div c$, $c \neq 0$

43) If a, b and c are three integers and $a > b$, then:

a) $a \times c > b \times c$ (when c is a positive number). We do not change the direction of the inequality, $a \times c < b \times c$ (when c is a negative number). We change the direction of the inequality.

b) $\frac{a}{b} > \frac{b}{c}$ (when c is a positive number). We do not change the direction of the inequality, $\frac{a}{c} < \frac{b}{c}$ (when c is a negative number). We change the direction of the inequality.

For example:

To solve the equation in $\mathbb{Z}$ we do as follows:

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Summary of the Term

If $2x - 5 = 13 \therefore 2x - 5 + 5 = 13 + 5$

$\therefore 2x = 18 \therefore x = \frac{18}{2} = 9 \therefore$ S.S = {9}

For example:

To solve the equation in $\mathbb{Z}$ we do as follows:

If $-2x + 5 \geq 5 \quad \therefore -2x + 5 - 5 \geq 5 - 5$

$\therefore -2x \geq 0 \quad \therefore \frac{-2x}{-2} \leq \frac{0}{-2}$

$\therefore x \leq 0 \quad \therefore$ S.S. = {0 , –1 , –2 , –3 , ...}

Unit 3

44) The distance between



two points A and B on a horizontal line *or* on a vertical line



is AB = | number of ending – number of starting |

= | B – A | = | 3 – (–2) | = 5 units.

45) To get the distance between two points in the coordinate plane:

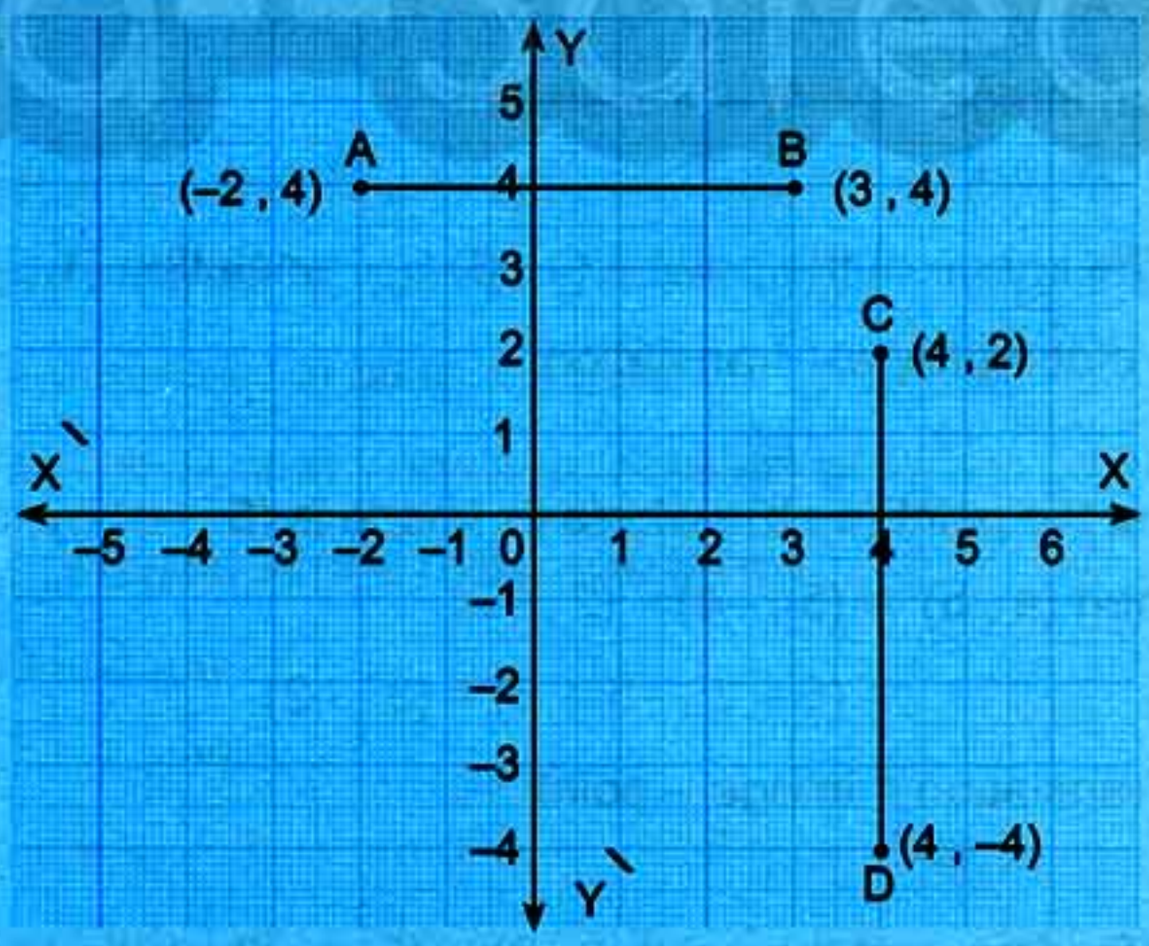
1) If $\overline{AB}$ // X – axis then AB = | difference between the 1st coordinates |

= | (–2) –3 | = 5 units

2) If $\overline{CD}$ // Y – axis then CD = ...

= | difference between the 2nd coordinates |

= | 2 – (–4) | = 6 units



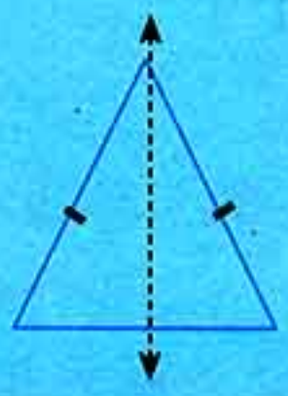
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46) If a figure has no symmetric axis, then it is not symmetric.

47) If the figure has one axis of symmetry or more, then it is called symmetric.

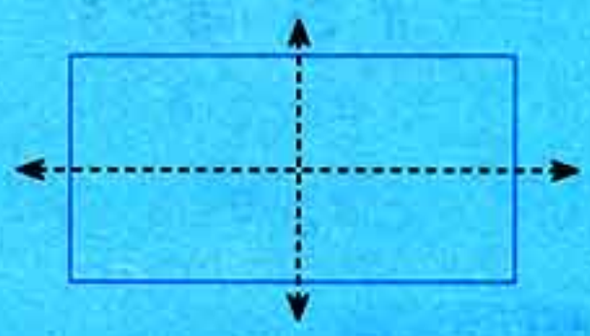
48) Some symmetric figures have one line of symmetry and others have more as follows:

a) Isosceles triangle has:



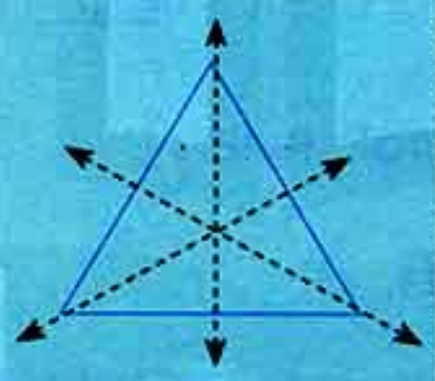
1 axis of symmetry

b) Rectangle has:



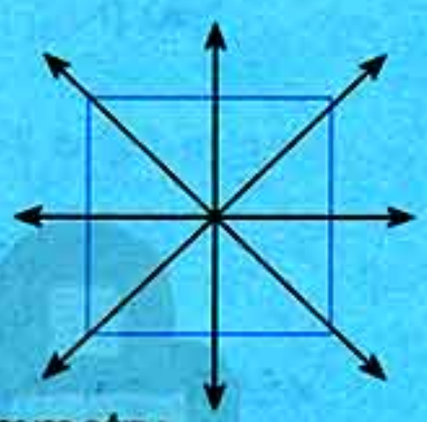
2 axes of symmetry

c) Equilateral triangle has:



3 axes of symmetry

d) Square has:



4 axes of symmetry

49) $A(x, y) \xrightarrow{\text{Translation (c, d)}} A'(x + c, y + d)$

For example:

The image of the point A (3 , –2) by translation $(x , y) \longrightarrow (x + 2 , y + 1)$

is: $A'(3 + 2 , -2 + 1) = A'(5 , -1)$

50) a) image = point + translation

For example:

The image of the point A (1 , 3) by translation (1 , –1) is (1 + 1 , 3 + (–1)) = (2 , 2)

b) Point = image – translation

For example:

Let the point (a , b) , where its image is (5 , –4) by translation (2 , –3)

then (a , b) = (5 , –4) – (2 , –3)

= (5 – 2 , –5 + 3) = (3 , –2)

c) Translation = image – point

For example:

If the image of the point (3 , 2) is (5 , 1), then the translation is (5 , 1) – (3 , 2) = (2 , –1)

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Summary of the Term

51) The circumference of a circle is the length of its closed curve = $2\pi r$

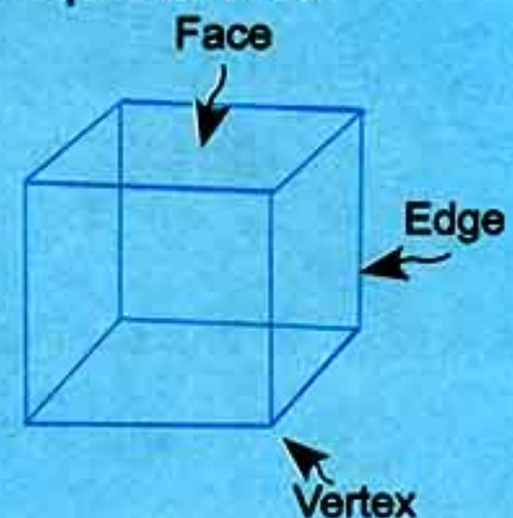
52) The area of the circle = πr^2

53) • A cube has 6 faces, each face is a square and all of them are equal in area.

• A cube has 12 edges and these edges are equal in length.

• A cube has 8 vertices.

• The volume of a cube = edge length × itself × itself.



54) The total area of a cube = the area of one face × 6

or = edge length × itself × 6

55) If a cube is without a lid, then the total area = the area of one face × 5

= edge length × itself × 5

Note: We consider any cube with a lid except if mentioned otherwise.

56) Area of one face of a cube = $\frac{\text{its lateral area}}{4}$

57) Area of one face of a cube with a lid = $\frac{\text{its total area}}{6}$

58) Area of one face of a cube without a lid = $\frac{\text{its total area}}{5}$

59) $\frac{\text{Lateral area of a cube}}{\text{Total area of a cube}} = \frac{4 \times S \times S}{6 \times S \times S} = 2 : 3$ (where S is the side length)

i.e. The ratio between the lateral area of a cube and its total area = 2 : 3

60) A cuboid has 6 faces, each face is a rectangle and each two opposite rectangles are congruent.

61) The area of each face of a cuboid = length × width = L × W



62) A cuboid is a 3-dimensional shape that has length, width and height (L, W, h).

63) A volume of a cuboid = length × width × height = L × W × h

64) A lateral area of a cuboid = perimeter of base × height

65) A total area of a cuboid = its lateral area + the sum of areas of its two bases

66) If the base of a cuboid is in the shape of a rectangle, then:

The lateral area = (L + W) × 2 × h

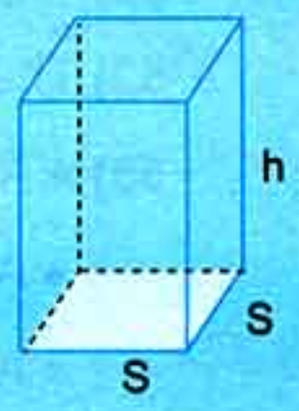
The area of the two bases = L × W × 2

The total area = the lateral area + the sum of areas of the two bases

= (L + W) × 2 × h + (L × W × 2)

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67) If the base of the cuboid in the shape of a square of side length S, then:



The lateral area = perimeter of base × height

$= S \times 4 \times h$

The area of the two bases = $S \times S \times 2$

The total area = the lateral area + the sum of areas of the two bases

$= (S \times 4 \times h) + (S \times S \times 2)$

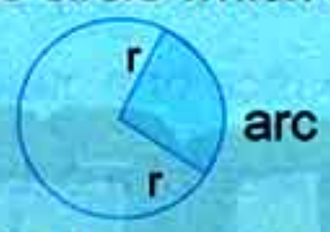
If this cuboid without a lid, then:

The total area = the lateral area + the area of one base

$= (S \times 4 \times h) + (S \times S)$

Unit 4

68) **The circular sector:** It is a part of the surface of the circle which is bounded by two radii and an arc.



The central angle: It is the angle whose vertex is in the centre of the circle.

69) The sum of the measures of the angles accumulating around the centre of the circle equals 360°

70) **Random experiment:** It is an experiment in which we can determine all its possible outcomes before carrying it out, but we can't predict certainly which of these outcomes will occur.

71) **Sample space (outcomes):** The set of all possible outcomes for a random experiment and we symbolise it by "S".

72) In a random experiment if A is an event where $A \subset S$, then p(A)

$= \frac{n(A)}{n(S)} = \frac{\text{number of elements of (A)}}{\text{number of elements of sample space (S)}}$

73) The probability of any event is not less than zero and not greater than 1,

so if $(A \subset S)$, then: $0 \leq P(A) \leq 1$

74) The probability of occurrence of the impossible event is zero: i.e. $P(\varnothing) = 0$

75) The probability of occurrence of the sure (or certain) event is one: i.e. $P(S) = 1$

76) The sum of the probabilities of all different events which contain only one element from the sample space "S" = 1

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Model Tests from the School Book

Model Test 1

1 Choose the correct answer:

1) $(-1)^8 + (-1)^9 =$ (0 *or* –1 *or* 1 *or* –2)

2) The image of the point (–3,4) by translation $(x, y - 4)$ is

((– 3,0) *or* (–7,4) *or* (–3,8) *or* (–1,4))

3) {0} ℕ ($\in$ *or* $\notin$ *or* $\subset$ *or* $\not\subset$)

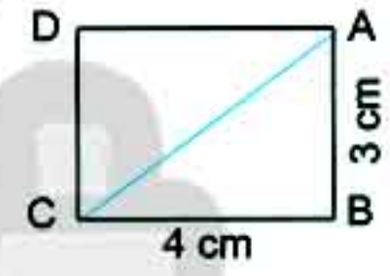
4) When tossing a die once and observing the upper face, then the probability of getting a number greater than 6 = ... ($\varnothing$ *or* 0 *or* $\frac{1}{6}$ *or* $\frac{1}{3}$)

2 Complete the following:

1) $\left|\frac{5-11}{3}\right|$ ℤ by using ($\in$ *or* $\notin$ *or* $\subset$ *or* $\not\subset$)

2) If $x + 6 = 2$ where $x \in \mathbb{Z}$, then $x =$

3) In the opposite figure ABCD is a rectangle, then the area of Δ ABC = ... cm^2.



4) A box contains 5 white balls, 3 blue balls and 8 red balls. All of the balls are identical. If a ball is chosen randomly when you close eyes, then the probability that the chosen ball is red = ...

3 a) Find the result: $(4 \times 3^2) \div 3^2 - (7 \times 3)$

b) Find the solution set of the inequality: $x - 2 \geq 3$ where $x \in \mathbb{Z}$

4 a) A cuboid box with a square base of side length 10 cm and its height is 7 cm. Find the lateral surface area of the box.

b) The circumference of a circle is 88 cm, find its area.

5 a) Find the solution set of the equation $3x + 9 = 3$ where $x \in \mathbb{Z}$.

b) The following table shows the percentage of the production of a factory of house electric sets.

Types of the sets	Washing machine	Oven	Heater	Mixer
Percentage of production	30%	40%	15%	15%

Represent these data using the circular sectors.

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Model Test 2

1 Choose the correct answer:

1) If $2x = 6$, then $x \in$ ($\mathbb{N}$ or $\varnothing$ or $\mathbb{Z}^+$ or $\mathbb{Z}^-$)

2) The circumference of the circle = ... $\times \pi$ (r or 2r or r^2 or r+2)

3) A die is tossed once, then the probability of getting the number 5 = ... (0 or $\frac{1}{6}$ or $\frac{5}{6}$ or 1)

4) The number which satisfies the inequality $x > -2$ is (–1 or –2 or –3 or –4)

2 Complete the following:

1) $\frac{2^3 \times 2^5}{2^2}$ = ...

2) The set of the counting numbers (©) $\mathbb{N}$

3) The total surface area of a cube is 150 cm^2, then its side length is cm.

4) The result of a mathematics test of October for 6^{th} grade in a school is recorded in the following table:

Excellent	Very good	Good	Weak
8	18	16	6

Then, the probability that a student obtains good = ...

3

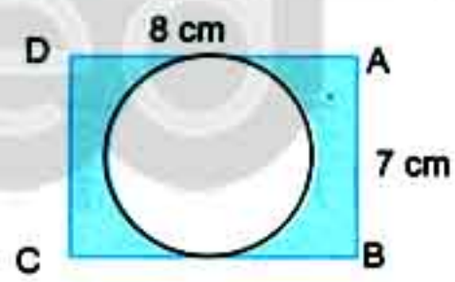
1) Find the value of $(6 \times -5) - ((2 \times 3) \div 3)$

2) Find the solution set of the inequality $x - 2 \geq 3$ where $x \in \mathbb{Z}$, then represent the solution on the number line.

4

a) Find the solution set of the equation $2x + 9 = 5$ where, $x \in \mathbb{Z}$.

b) In the opposite figure ABCD is a rectangle, its length is 8 cm and its width is 7 cm. Calculate the area of the shaded part.



5

a) On the coordinate plane, determine the following points A (2,3), B (4,3) and C (4,7) then find:

1) The length of $\overline{BC}$ = ... length units.

2) The image of Δ ABC by translation (0 , –4).

b) The following table shows the percentage of a number of students who participated in school activities.

Activity	Cultural	Sports	Social	Arts
Percentage of students	5%	45%	15%	35%

Represent these previous data by the circular sectors.

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Model Test 3

(for students with special needs)

1 Complete the following:

1) $|3|$ = ...

2) The probability of the impossible event = ...

3) If $x + 2 = 3$, $x \in \mathbb{N}$, then x = ...

4) The perimeter of the base of a cuboid is 10 cm, its height is 4 cm. Then its lateral area = ... cm^2.

2 Choose the correct answer:

1) $2^5 \times 2^2$ = ... (2^7 or 4^7 or 1)

2) The surface area of a circle = $\pi \times$ (r or r^2 or 2r)

3) $\mathbb{Z}^+ \cup \{0\}$ = ... ($\mathbb{Z}^-$ or $\mathbb{N}$ or $\mathbb{Z}$)

4) When tossing a die once, then probability of getting an odd number = ... ($\frac{1}{6}$ or $\frac{1}{3}$ or $\frac{1}{2}$)

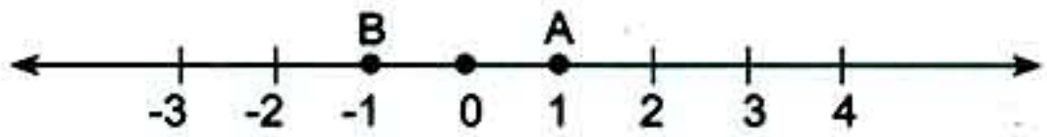
3 Put (✓) true or (✗) false:

1) $|-5| + 5 = 10$ ()

2) If $3x = 9$, then $x = -3$ ()

3) The probability of the sure event = zero. ()

4) In the following figure the distance between points A and B = 2 units. ()



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4 Join from column (A) to column (B):

	A	B
1	The sum of the measures of the angles of the sectors about the centre of the circle = ...	∈
2	2 $\mathbb{Z}^+$	360°
3	The solution set of the inequality $x + 2 < 5, x \in \mathbb{N}$, is	(4 , 4)
4	The image of the point (3 , 2) by translation (1 , 2) is	{0 , 1 , 2}

5 Complete the following:

a) The length of the edges of a cube is 4 cm. **Calculate its total area and lateral area:**

The total area = 6 × The lateral area = 4 ×

b) Find the result: $\frac{2^3 \times (-2)^4}{2^5} = \frac{2^{\cdots\cdots + \cdots\cdots}}{2^5} = 2^{\cdots\cdots} =$

ذاكرولى
RaNia-SaYed

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24 Examinations from Different Governorates 2018/2019

(Note: Show your steps at the 3rd question in each exam.)

1 Cairo - EL-Sahel Educational Zone

1 Choose the correct answer:

1) $\mathbb{Z}^- \cap \mathbb{N}$ = ... ($\mathbb{Z}$ or $\mathbb{N}$ or $\mathbb{Z}^-$ or $\varnothing$)

2) The additive inverse of $(-3)^2$ is $\left((3)^2 \text{ or } (-2)^3 \text{ or } -(3)^2 \text{ or } \frac{1}{9}\right)$

3) The equation $x^2 + 1 = 3$ is of the degree. (first or second or third or fourth)

4) If a fair die is thrown once, then the probability of getting the number 5 equals

($\frac{5}{6}$ or Zero or $\frac{1}{6}$ or 1)

5) If a = 2 , b = – 4, then 3 ab = ... (–10 or –24 or 2 or –12)

6) If A (2 , 3) and B (6 , 3), then the length of $\overline{AB}$ is length units. (2 or 3 or 4 or 5)

7) A circle of diameter length 10 cm, its area = ... π cm^2. (100 or 50 or 25 or 5)

8) If $x = -2$, y = |–3|, then $x + y$ = ... (–5 or 1 or 5 or 6)

9) The image of the point by translation $(x - 3 , y + 4)$ is (–5 , –3).

((–2 , –7) or (–2 , 7) or (–8 , 7) or (–8 , 15))

10) $2^3 \times 2^2$ = ... (4^6 or 4^5 or 2^6 or 2^5)

11) If the probability of success of a student is 0.8, then the probability of his failure is

(80% or 0.4 or 1 or 0.2)

12) If the set of substitution is {1 , 2 , 3 , 4}, then the solution set of the equation

$x + 6 = 10$ is ({1} or {2} or {3} or {4})

2 Complete each of the following:

13) A cube, the area of its face = 9 cm^2, then its total surface area = ... cm^2

14) $\mathbb{Z} - \mathbb{Z}^+$ = ...

15) The image of the point (–2 , 5) by translation (1 , –3) is

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16) If $2x = 6$ then $6x =$

17) The sum of measures of the angles of the sectors around the centre of the circle = ... °

18) If the perimeter of the base of a cuboid is 10 cm, its height is 5 cm, then its lateral area = ... cm^2.

19) If $-x > 3$, then $x <$

20) The total area of a cuboid is 132 cm^2 and its lateral area is 112 cm^2, then the area of its base is cm^2.

3 Answer the following questions:

21) Find the solution set of the equation $3x - 7 = 11$, where $x \in \mathbb{Z}$.

22) A circle of diameter length 14 cm is divided into 7 equal circular sectors, calculate the surface area of one sector where $\left(\pi = \frac{22}{7}\right)$.

23) Find the solution set of the inequality $x - 2 \leq 3$ where $x \in \mathbb{N}$

24) If the perimeter of the base of a cube is 28 cm:

a) Calculate its lateral area.

b) Calculate its total surface area.

25) The following table shows the percentages of a number of students participating in the school activities.

Activities	Arts	Sports	Computer
Percentages	25%	40%	35%

Represent these data by circular sectors (pie chart).

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2 Cairo - Heliopolis Directorate - St.Joseph's School

1 Choose the correct answer:

1) $\mathbb{Z} - \mathbb{Z}^-$ = ... ($\mathbb{Z}^-$ or $\mathbb{Z}^+$ or {0} or $\mathbb{N}$)

2) $2^3 + 1^3$ = ... (3^3 or 3^6 or 3^2 or 3^9)

3) The image of the point (–3 , –3) by translation 3 units in the positive direction of y-axis is ((0 , 0) or (0 , –3) or (–3 , 0) or (–3 , 3))

4) The measure of a angle of the sector which represents third of the circle = ... ° (30 or 60 or 120 or 180)

5) The number that satisfies the inequality $x > -2$ is (–1 or –2 or –3 or –4)

6) If a < b, then –3a –3b (< or > or = or ≤)

7) When tossing a fair die once, then the probability of getting the number 3 is ($\frac{1}{2}$ or $\frac{1}{3}$ or $\frac{1}{6}$ or 1)

8) If $2x + |-3| = 1$, then x = ... (2 or –1 or –4 or 8)

9) The lateral area of the cube of edge length 10 cm is cm^2. (40 or 400 or 600 or 1000)

10) The additive inverse of $(-1)^6$ is ($(1)^6$ or $(-1)^7$ or $(-1)^8$ or $(-1)^0$)

11) $|-4| + (-2)$ $\mathbb{N}$ ($\in$ or $\notin$ or $\subset$ or $\not\subset$)

12) The circumference of the circle = ... (πr or $2\pi r$ or πr^2 or $2\pi r^2$)

2 Complete the following:

13) The lateral area of the cuboid = the perimeter of base ×

14) The greatest negative integer is

15) The probability of the impossible event = ...

16) $\frac{(-3)^7 \times (-3)^2}{(-3)^6} = (-3)^x$, then x = ...

17) If A (–3 , 2) and B (–3 , – 4), then the length of $\overline{AB}$ = ... length unit(s).

18) 3 × (–5) = (–5) × 3 is called property

19) $\{x : x \in \mathbb{Z} , -2 < x \leq 1\}$ = ... in listing method.

20) The image of the point (0 , –2) by translation (x – 3, y + 2) is

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3 Answer the following questions:

21) Find the solution set in $\mathbb{Z}$ of the equation: $2x + 11 = 3$

.....

.....

22) Use the properties of addition and multiplication to find the result of:

$37 \times 17 + 37 \times (-17)$

.....

.....

23) A carpet in the shape of a circle of radius length 3.5 m. If the price of one metre square of this carpet is 100 pounds, then find the price of the whole carpet. $\left(\pi \simeq \frac{22}{7}\right)$

.....

.....

24) Find the total area of a cuboid box of dimensions 3 cm, 2 cm and 6 cm.

.....

.....

25) The following table shows the percentages of a number of students participating in some favourite school activities:

Activities	Sports	Reading	Music
Percentages	25%	35%	40%

Represent these data by a pie chart.

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3 Cairo - El-Sayeda Aisha - Rod El-Farag Educational Zone

1 Choose the correct answer:

1) –5 $\mathbb{Z}^+$ ($\in$ or $\notin$ or $\subset$ or $\not\subset$)

2) If $2x = 8$, then $x + 1$ = ... (4 or 2 or 16 or 5)

3) A circle of diameter 8 cm, its area = ... π cm^2 (4 or 8 or 16 or 64)

4) If a = –3 , b = 2, then $(a)^b$ = ... (–6 or 9 or –9 or –8)

5) $(-1)^{13} + (-1)^{10}$ = ... (0 or 2 or 1 or –2)

6) The number that satisfies the inequality $x > -4$ is (–5 or –6 or – 4 or –3)

7) If the area of one face of a cube is 9 cm^2, then its total area = ... cm^2.
(12 or 27 or 36 or 54)

8) The probability of the impossible event is (0 or 1 or –1 or 2)

9) If A (2 , 7), B (2 , 3), then the length of $\overline{AB}$ = ... units. (3 or 4 or 5 or 7)

10) $9^7 + 9^5$ = ... (9^{14} or 9^2 or 9^{zero} or 9^{35})

11) The equation $3x^3 - 6 = 14$ is of the degree. (first or second or third or fourth)

12) The measure of the angle of the circular sector which represents $\frac{1}{4}$ from the area of a circle is (30° or 60° or 90° or 45°)

2 Complete the following:

13) The image of the point (–1 , 4) by translation $(x + 1, y - 3)$ is

14) $\mathbb{Z}^+ \cap \mathbb{Z}^-$ = ...

15) A fair die is thrown once, then the probability of getting the number 5 is

16) The lateral area of the cuboid = perimeter of base X

17) $\frac{(-2)^7 \times (-2)^5}{-2^{10}}$ = ...

18) The sum edge lengths of cube is 48 cm, then its lateral area = ... cm^2.

19) If $x = -2$, $y = |4|$, then xy = ...

20) The cuboid of lateral area 120 cm^2 and perimeter base 20 cm, its height = ... cm.

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Final Examinations from Different Governorates 2018/2019

3 Answer the following questions:

21) Use the distributive property to **find**: $32 \times 117 - 32 \times 17$

.....

.....

22) **Find** the S.S. of the inequality $2x - 2 \geq 4$, where $x \in \mathbb{Z}$.

.....

.....

.....

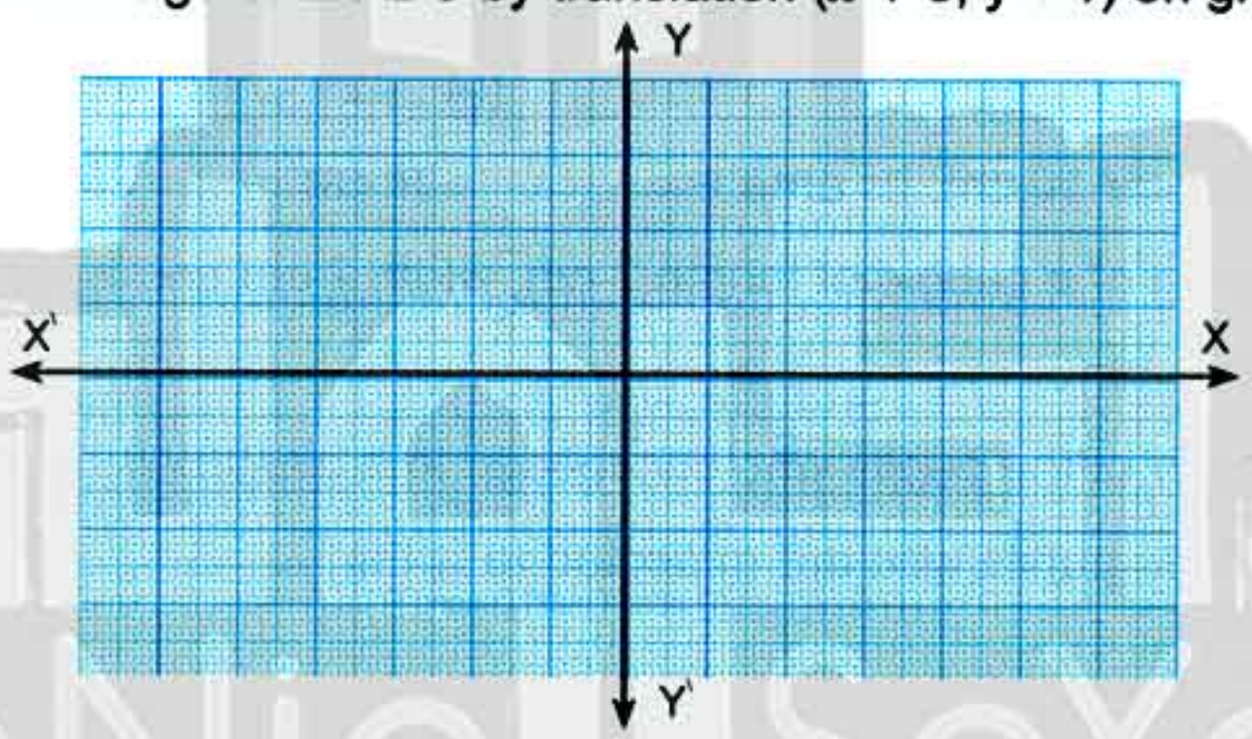
23) A cuboid box with a square base of side length 10 cm and its height is 6 cm.

Find its lateral area and total area.

.....

.....

24) In the Cartesian coordinate plane **locate** the points A (1 , 1) , B (–3 , –1), C (0 , –2), then **draw** the image of Δ ABC by translation $(x + 5, y - 1)$ on graph.



25) From the following table:

Farm	1st	2nd	3rd	4th
Percentage of the production	40%	25%	20%	15%

Represent these data by a pie chart.

.....

.....

.....

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4 Cairo - Al-Zeitoun Educational Administration - Gomhoria Language School

1 Choose the correct answer:

1) $(-1)^3$ $(3)^{zero}$ ($<$ or $=$ or $>$ or $\geq$)

2) $|-5| + 4$ $\mathbb{Z}^-$ ($\in$ or $\notin$ or $\subset$ or $\not\subset$)

3) The smallest non-negative number is (1 or 0 or –1 or –2)

4) $x + 1 = 7$ is of the degree (zero or 1st or 2nd or 3rd)

5) The solution set of the inequality $-2 \leq x < -1$ is

({–2 , –1} or {–1} or {–2} or $\varnothing$)

6) The additive inverse of |–3| is (0 or 3 or –1 or –3)

7) $\frac{25-5}{4}$ $\mathbb{Z}$. ($\in$ or $\notin$ or $\subset$ or $\not\subset$)

8) The image of the point (4 , –2) by translation ($x + 2$, y –1) is

((4 , –2) or (2 , –1) or (6 , –3) or (–2 , –1))

9) A circle of diameter 10 cm, its area = ... π cm^2. (25 or 100 or 3.14 or 31.4)

10) The lateral area of a cuboid of length 3 cm, width 2 cm and height 4 cm is cm^2 (20 or 24 or 40 or 52)

11) If the probability of the pupils who succeeded in a classroom is 0.7, then the probability of the pupils who are expected to fail is

(0.3 or 0.1 or 12 or 28)

12) P ($\varnothing$) = ... (1 or 0 or $\frac{1}{2}$ or $\frac{5}{3}$)

2 Complete the following:

13) The solution set of inequality $x - 1 < 0$ in $\mathbb{N}$ is

14) $\mathbb{Z}^+ - \mathbb{Z}^-$ = ...

15) A circle its circumference is 88 cm, then its radius length = ... cm. $(\pi \simeq \frac{22}{7})$

16) $\frac{2^2 \times 2^6}{2^3}$ = ...

17) A cube of volume 1000 cm^3, its side length is cm.

18) Having A (–2 , 1) and B (3 , 1), then the length of $\overline{AB}$ = ... length unit(s).

19) The probability of the certain event = ...

20) If the area of one face of a cube is 9 cm^2, then its total area = ...

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Final Examinations from Different Governorates 2018/2019

3 Answer the following questions:

21) Use the distribution property to find: $3 \times (-2) + 3 \times 5$

.....

.....

.....

22) Find the solution set in $\mathbb{N}$: $3x - 2 = -17$

.....

.....

.....

23) The sum of edge lengths of a cube is 144 cm. Find its lateral area and its total area.

.....

.....

.....

24) Find the area of the shaded part: $\left(\pi \simeq \frac{22}{7}\right)$

.....

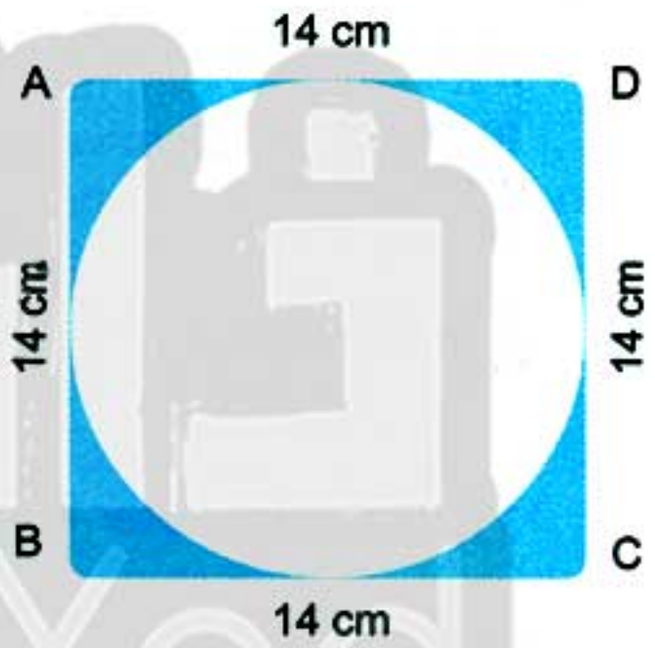
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25) The following table shows the number of students participating in school activities.

Activities	Cultural	Sports	Social	Arts
Percentages	25%	50%	15%	10%

Represent these data by a pie chart.

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5 Cairo - El-Marg Educational Directorate - El-Shams Language School

1 Choose the correct answer:

1) When tossing a coin once, then the probability of getting a head is

(0 or 1 or 0.5)

2) If the area of one face of a cube is 9 cm^2, then its total surface area is cm^2

(36 or 54 or 81)

3) $\mathbb{Z}^+ \cap \mathbb{Z}^-$ = ...

($\mathbb{Z}$ or $\varnothing$ or $\mathbb{Z}$)

4) The measure of the central angle of the circular sector which represents $\frac{1}{12}$ from the area of the circle = ...

(90° or 60° or 30°)

5) $(-1)^8 + (-1)^9 + (-1)^{zero}$ = ...

(–1 or 1 or 0)

6) If a dice is tossed once, then the probability of getting a prime number = ...

($\frac{1}{3}$ or $\frac{1}{2}$ or 1)

7) If $4x = 24$, $x \in \mathbb{Z}$, then x = ...

(12 or 24 or 6)

8) The multiplicative neutral element in $\mathbb{Z}$ is

(0 or 1 or 2)

9) $|-5| + 3$ $\mathbb{Z}$

($\in$ or $\subset$ or $\notin$)

10) The image of the point (–1 , 2) by translation (–2 , 3) is

((0 , 5) or (1 , 3) or (–3 , 5))

11) If the diameter length of a circle is 20 cm, then its area = ... cm^2. where ($\pi = 3.14$)

(314 or 3.14 or 0.314)

12) $5 \times |-4|$ = ...

(20 or –20 or 9)

13) $5^7 + 5^5$ = ...

(5^{12} or 5^2 or 5^0)

14) $\varnothing$ {a , b}

($\in$ or $\subset$ or $\notin$)

2 Complete the following:

15) $3 \times (-2) = (-2) \times 3$ is called property.

16) $(-4) \times [(4) + (-4)]$ = ...

17) If A (2 , 4) and B (2 , –1), then the length of $\overline{AB}$ = ... units.

18) If the sum of edge lengths of a cube is 96 cm, then its lateral area = ... cm^2.

19) If the equation: $x^2 - 3 = 6$ is of the degree.

20) If $x \in \{2 , -2\} \cap \{4 , -2\}$, then x = ...

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21) $\frac{5^3 \times 5^4}{5^7}$ = ...

22) If the probability of the appearance of the event A is $\frac{5}{7}$, then the probability of the non-appearance of the event A = ...

3 Answer the following questions:

23) a) **Find** the solution set in $\mathbb{Z}$ of the equation: $2x+1 = -9$

.....

.....

.....

b) **Find** the solution set in $\mathbb{Z}$ of the inequality: $3x - 2 \leq 7$

.....

.....

24) A cuboid its length is 6 cm, its width is 4 cm and its height is 8 cm. **Find** its lateral area and its total area.

.....

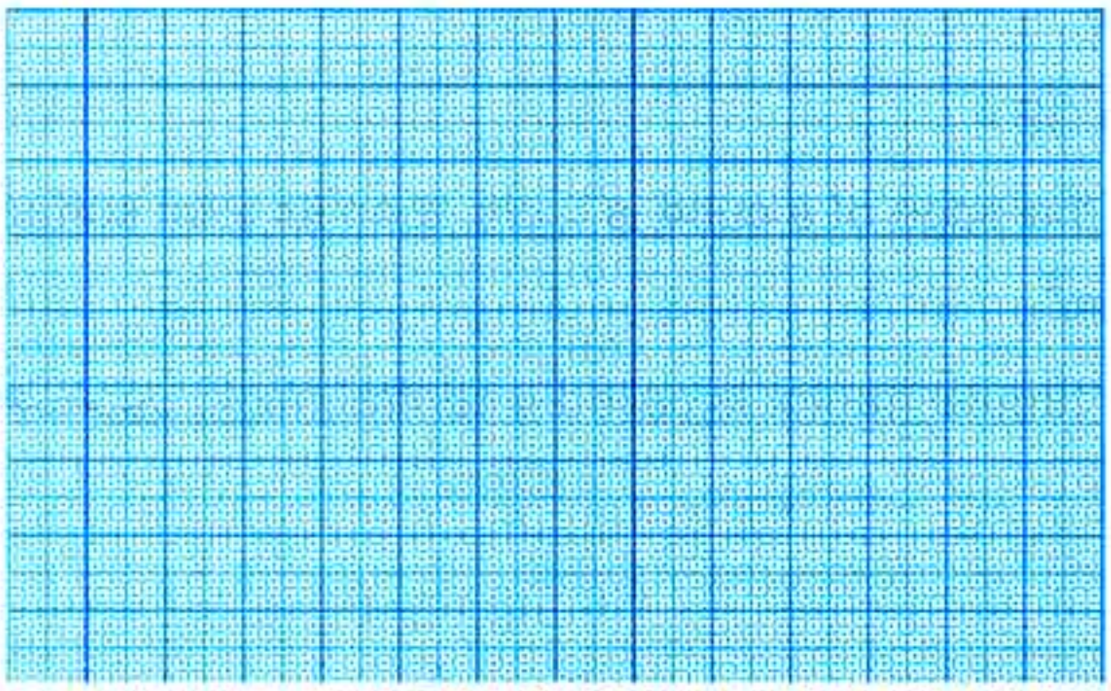
.....

25) The following table shows the percentages of the favourite sport for the pupils in one of the schools:

Favourite sports	Football	Handball	Basketball
Percentage	50%	30%	20%

Represent these data by circular sectors.

26) On the coordinate plane, **determine** the points A (2 , 2), B (1, 0), C(3 , 0) , D (4 , 2), then **find** its image by translation (x, y + 4) and **what** is the name of the shape ABCD?



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الصف السادس الابتدائى موقع ذاكرولى التعليمى كتاب Gem

6 Giza - 6th October Directorate - Sun Gate L.Schools

1 Choose the correct answer from those given:

1) The integer number which is included between –2 and 3 is (3 or –3 or –4 or –1)

2) $\frac{-5}{7}$ $\mathbb{Z}$ ($\notin$ or $\subset$ or $\not\subset$ or $\in$)

3) $(-1)^2 + 1$ = ... (–2 or 0 or 1 or 2)

4) The image of the point (–3 , 4) by translation (0 , – 4) is

[(–3 , 0) or (–7 , 4) or (–3 , 8) or (–1 , 4)]

5) {Zero} $\subset$ ($\mathbb{Z}^+$ or $\mathbb{Z}^-$ or $\varnothing$ or $\mathbb{Z}$)

6) A cube of edge length 6 cm, its total area = ... cm^2 (36 or 72 or 144 or 216)

7) A die is thrown once, then the probability of getting the number 5 = ...

(0 or $\frac{1}{6}$ or $\frac{5}{6}$ or 1)

8) If the length of the radius of a circle is 10 cm, then its surface area equals cm^2. ($\pi \simeq 3.14$) (3.14 or 31.4 or 314 or 3140)

9) If $x - 1 = 2$, then x = ... where $x \in \mathbb{N}$ (3 or 1 or –1 or –3)

10) $|-7| + 7$ = ... (–14 or zero or 7 or 14)

11) If the total area of a cube is 600 cm^2, then its edge length = ... cm

(5 or 10 or 6 or 100)

12) The measure of the angle for the circular sector of half a circle is

(90° or 120° or 180° or 270°)

2 Complete each of the following:

13) The probability of the impossible event = ...

14) $\mathbb{Z}^+ \cap \mathbb{Z}^-$ = ...

15) $32 \times 85 + 15 \times 32$ = ...

16) If the length of the edge of a cube is 4 cm, then its total surface area equals cm^2.

17) The angle of a circular sector is called a central angle because its vertex is of the circle.

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18) The solution set of the inequality: $x + 1 < 5, x \in \mathbb{N}$ is

19) If $x \subset \{2, -3\} \cap \{5, -3\}$, then x = ...

20) The lateral area of a cuboid = ...

3 Answer the following questions:

21) Find the result of each of the following:

a) $(-5) \times [7 + (-5)]$ **b)** $\frac{7^4 \times 7^5}{7^7}$

22) Find the solution set of the inequality: $2x - 3 < 1$ where $x \in \mathbb{N}$ and represent it on the number line.

23) Find the solution set, where $x \in \mathbb{Z} : x + 4 > 5$.

24) In the coordinate plane, represent the points A (0 , 1), B (2 , 1) and C (2 , 4), then find:

a) The length of $\overline{BC}$.

b) The image of Δ ABC by translation (0 , 2).

25) The following table shows the number of students participating in some activities:

Activities	Cultural	Sports	Social	Arts
Percentages	10%	40%	15%	35%

Represent these data by a pie graph.

RaNia SaYed

هذا العمل خاص بموقع ذاكرولى التعليمى ولا يسمح بتداوله على مواقع أخرى

الصف السادس الابتدائى موقع ذاكرولى التعليمى كتاب Gem

7 Giza - Al-Haram Educational Area

1 Choose the correct answer:

1) $\mathbb{Z}^+ \cap \mathbb{Z}^-$ = ... ($\mathbb{Z}^+$ or $\mathbb{Z}^-$ or $\varnothing$ or $\mathbb{N}$)

2) The greatest negative integer is (0 or –1 or 1 or 2)

3) If $7x = -14$, then x = ... (7 or –2 or –7 or –21)

4) The degree of the equation $x^3 - 4x^2 = 12$ is (3^{rd} or 2^{nd} or 1^{st} or 4^{th})

5) All the following numbers satisfy the inequality $x > -3$ except

(0 or –1 or –2 or –4)

6) The image of the point (–3 , 5) by translation ($x + 3$, $y - 5$) is

((6 , 10) or (0 , 5) or (0 , 0) or (3 , 0))

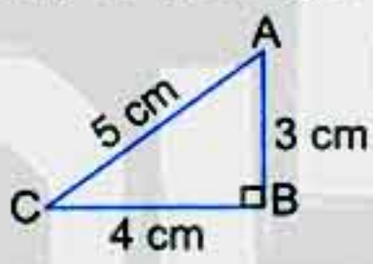
7) If $x = -1$, $y = 2$, then the value of $x + y$ = ... (2 or 3 or 1 or –1)

8) $(-1)^8 + (-1)^9$ = ... (1 or Zero or 2 or –2)

9) When tossing a coin the probability of getting a head is $\left(\frac{1}{2}\right.$ or 1 or $\frac{3}{4}$ or $\left.\frac{1}{4}\right)$

10) **In the opposite figure:**

Area of Δ ABC = ...cm^2 (12 or 6 or 10 or 7.5)



11) If a circular sector represents $\frac{1}{3}$ of a circle, then the measure of its central angle = ...

(120° or 90° or 60° or 180°)

12) A cube its edge length is 3 cm, then its total area = ... cm^2. (54 or 36 or 27 or 9)

2 Complete the following:

13) If a = 3 , b = –2, then the value of: –3 ab = ...

14) If $x - 3 = 4$, then x = ...

15) If x = (3 , 2), y = (3 , – 4), then the length of $\overline{xy}$ = ... units.

16) A cuboid, its dimensions are 3 cm, 4 cm and 5 cm, then its lateral area = ... cm^2.

17) If $2y = 8$, then $y + 3$ = ...

18) The probability of the impossible event = ...

19) A circle, its radius length is 7 cm and then its circumference = ... π cm.

20) The lateral area of the cube = area of one face ×

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كتاب Gem موقع ذاكرولى التعليمى الصف السادس الابتدائى

3 Answer the following questions:

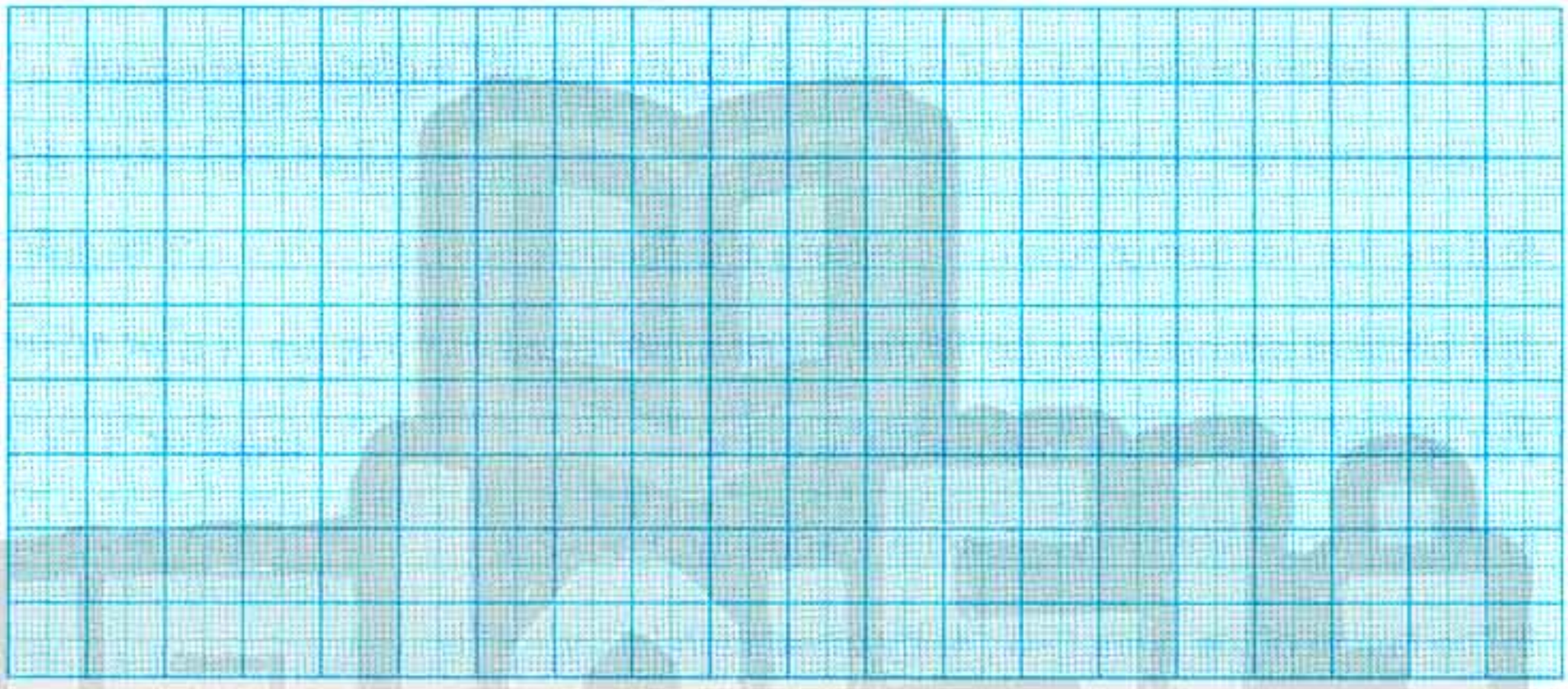
21) Simplify: $\frac{7^5 \times 7}{7^4}$ (Show the steps.)

.....

.....

.....

22) In the Cartesian coordinate plane, draw Δ ABC where A (1 , 1), B (4 , 1) and C (4 , 4), then find the image of Δ ABC by translation (1 , –2)

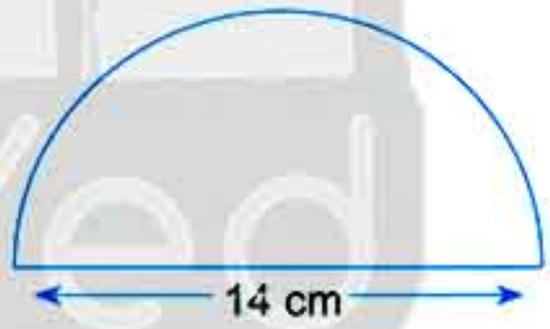


23) Find the area of the given figure. $\left(\pi \simeq \frac{22}{7}\right)$

.....

.....

.....



24) Find the solution set of each of the following:

a) $2x + 9 = 13 \quad (x \in \mathbb{Z})$ b) $x - 1 < 2 \quad (x \in \mathbb{N})$

25) The following table shows the percentage of production of a factory of home electric appliances.

Kinds of appliances	Washing machine	Heater	Oven	Mixer
Percentage	25%	25%	20%	30%

Represent these data by circular sectors.

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كتاب Gem موقع ذاكرولى التعليمى الصف السادس الابتدائى

8 Giza - Orman Private School

1 Choose the correct answer:

1) $\mathbb{Z} - \mathbb{N}$ = ... ($\mathbb{Z}^+$ or $\mathbb{Z}^-$ or $\mathbb{Z}$ or $\mathbb{N}$)

2) $(-1)^8$ $(-1)^9$ (> or < or = or ≤)

3) The area of the square = side length × (side length or diagonal or height or width)

4) If the length of the radius of a circle is 10 cm, then its surface area equals cm^2.
Given that ($\pi = 3.14$) (3.14 or 31.4 or 314 or 3140)

5) If $x - 2 = -4$, then x = ... where $x \in \mathbb{Z}$ (2 or 4 or –2 or – 4)

6) A circle of diameter length 10 cm, its circumference = ... π cm. (5 or 10 or 15 or 25)

7) The probability of the impossible event = ... (zero or 1 or 0.5 or 1.2)

8) The number which satisfies the inequality: $x > -2$ is (–1 or –2 or –3 or –4)

9)The image of the point (–3 , 4) by translation (x , y – 4) is
((–3 , 0) or (–7 , 4) or (–3 , 8) or (–1 , 4))

10) The smallest non-negative integer number is (1 or 0 or –1 or 2)

11) If $x - 1 = 2$, then x = ... (3 or 13 or 17 or 11)

12) The equation: $3x^3 + 5 = 5$ is of the degree. (first or second or third or fourth)

13) The height of a cuboid whose total area is 120 cm^2 and the dimensions of its base are 4 cm and 6 cm equals cm. (3 or 6 or 6.3 or 3.6)

14) The probability of getting a number divisible by 3 in an experiment of rolling a fair die once is (0 or $\frac{1}{3}$ or $\frac{1}{2}$ or 1)

2 Complete each of the following:

15) The perimeter of the rectangle = ...

16) $\mathbb{Z}^+ \cap \mathbb{Z}^-$ = ...

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الصف السادس الابتدائى

17) The probability of the sure event = ...

18) The additive identity element in $\mathbb{Z}$ is

19) The lateral area of a cube = the area of one face ×

20) The equation: $5x^2 - 3 = 17$ is of the degree.

3 Answer the following questions:

21) **Find** the result of: $\frac{(-2)^7 \times (-2)^5}{(-2)^9}$

22) **Find** the solution set of the equation:

$2x - 3 = -9$, where $x \in \mathbb{Z}$

23) **Find** the solution set of the inequality:

$2x - 1 \leq 5$, where $x \in \mathbb{N}$, then represent the solution set on the number line.

24) A circle, its circumference is 88 cm, **calculate** the area of its surface where $\left(\pi \simeq \frac{22}{7}\right)$.

25) A cuboid whose total area is 132 cm^2 and its lateral area is 112 cm^2. **Calculate** the area of its base.

26) The following table shows the percentages of production of chickens on four farms within one month:

Farms	First	Second	Third	Fourth
Percentages of production	15%	30%	20%	35%

Represent these data by circular sectors.

هذا العمل خاص بموقع ذاكرولى التعليمى ولا يسمح بتداوله على مواقع أخرى

9 Alexandria - Mathematics Inspection

1 Complete the following:

1) If $x = |-8|$, then $x =$

2) If a dice is rolled once, then the probability of getting a number ≤ 5 is

3) 3 km = ... metres.

4) The height of the cuboid whose lateral area is 150 cm^2 and the dimensions of its base are 6 cm and 9 cm is cm.

5) If $2x = -6$, $x \in \mathbb{Z}$, then the set of solution is

6) The surface area of the semi-circle is π cm^2.

7) The number which if it is added to its double, the result will be 9 is

8) The image of the point (2 , –1) by translation 3 units in the positive direction of x-axis is

2 Choose the correct answer:

9) $(3)^8 \div (-3)^5$ = ... ($(-3)^3$ or $(3)^3$ or (–3) or 3)

10) If $\left|\frac{x}{3}\right| = 4$, then x = ... (12 or (–12) or –12 only or 12 only or others)

11) The solution set of inequality $2 \leq x < 3$, where $x \in \mathbb{N}$ is
({5} or {2} or {2 , 1.5} or {2 , 3})

12) The ratio between the total area and lateral area of a cube = ...
(1 : 4 or 2 : 3 or 3 : 2 or 4 : 1)

13) $\frac{81}{3}$ $\mathbb{Z}^+$ ($\in$ or $\notin$ or $\not\subset$ or $\subset$)

14) The solution set of the inequality $x < 0$ in $\mathbb{Z}$ is
($\mathbb{Z}^+$ or $\mathbb{Z}^-$ or $\mathbb{N}$ or $\varnothing$)

15) If the probability of failure of a student is 0.23, then the probability of his success = ... (1 or 0.23 or 0.77 or 7.7)

16) $36 \times 65 + 15 \times (-36) = 36\ (65$ $15)$ (– or + or × or +)

17) If $\varnothing$ is the empty set, then P ($\varnothing$) = ... (1 or 0 or 0.5 or $\varnothing$)

18) The circle whose diameter length is 14 cm, its area = ... where $\left(\pi \simeq \frac{22}{7}\right)$
(44 cm^2 or 154 cm^2 or 154 cm or 44 cm)

19) The number which satisfies the equation: $x + 3 = -17$, where $x \in \mathbb{Z}$ is
(15 or –5 or 5 or –20)

20) If A (– 4 , 4), B (1 , 4), then the length of $\overline{AB}$ = ... units (–5 or 5 or 3 or –3)

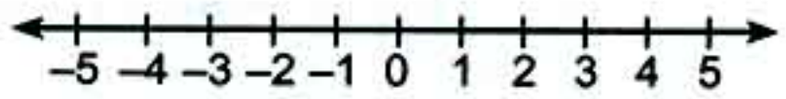
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Final Examinations from Different Governorates 2018/2019

3 Answer the following questions:

21) Find the solution set of the inequality $2x - 2 \leq 4$, where $x \in \mathbb{Z}$, then represent the solution set on the number line.



.....

.....

22) If a = –2, b = –3 , c = 0, then find the value of: $-(a + b)^{c}$.

.....

.....

.....

23) The total area of a cube is 468 cm^2, find:

1) The area of one face

2) The lateral area

.....

.....

24) On the coordinate plane,

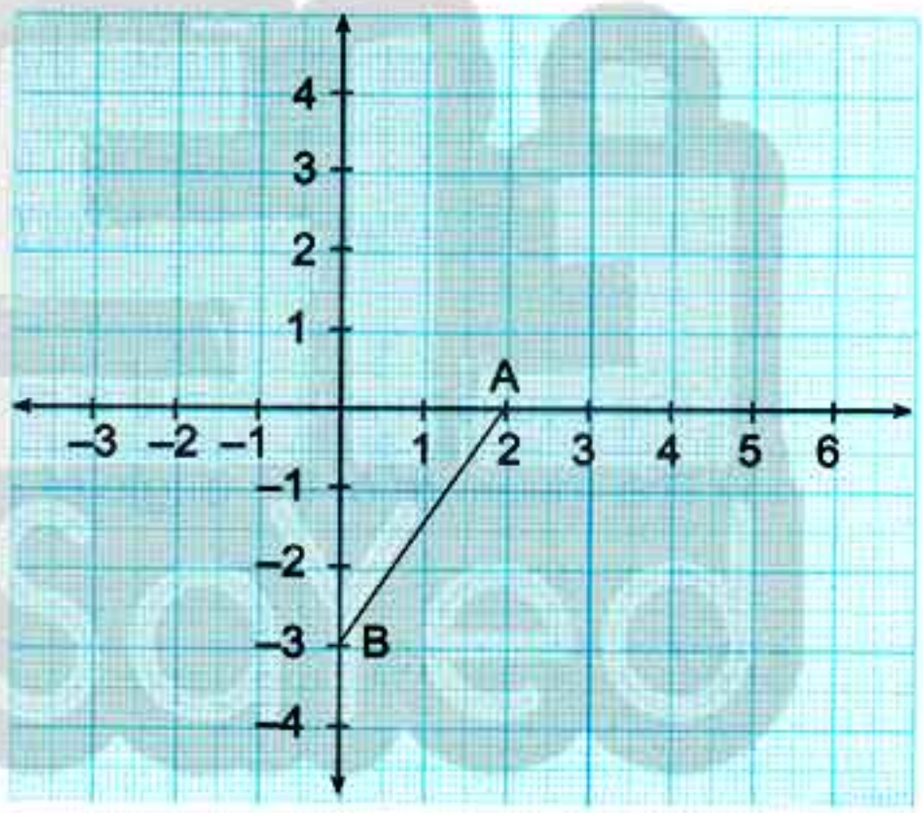
find and draw the image of $\overline{AB}$

by translation (2 , –1)

A` = (..... , .....) , B` = (..... , ...)

.....

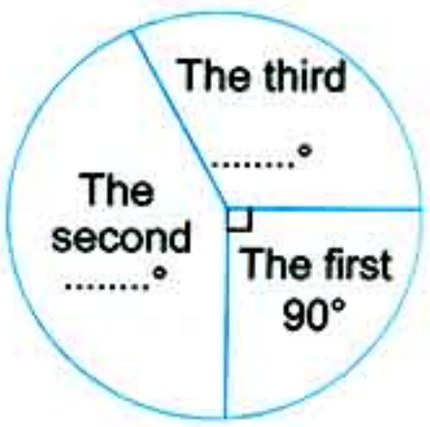
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25) The following table shows the percentage of production of three farms.

Farms	The first	The second	The third
The percentage	%.....	%.....	30%

Complete the previous table and find the measures of the central angles of the opposite circular sectors.



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كتاب Gem موقع ذاكرولى التعليمى الصف السادس الابتدائى

10 Alexandria - El-Montazah Educational Zone

1 Choose the correct answer:

1) $(-1)^7 + (-1)^4$ = ... (zero or 1 or –1 or 11)

2) The image of the point (2 , –3) by translation (x – 1 , y) is

((1 , –3) or (2 , –1) or (2 , – 4) or (–1, –3))

3) 0..... $\mathbb{Z}$. ($\in$ or $\notin$ or $\subset$ or $\not\subset$)

4) The symbolic expression for "x is less than or equal to 2" is

($x > 2$ or $x < 2$ or $x \leq 2$ or $x = 2$)

5) If a regular die is tossed once, then the probability of the appearance of the number 4 = ... (zero or $\frac{4}{6}$ or $\frac{1}{6}$ or 4)

6) The area of the circle whose radius length is 7 cm = ... cm^2.

(7 π or 14 π or 42 π or 49 π)

7) The neutral element of addition in $\mathbb{Z}$ is (1 or 0 or –1 or 2)

8) The number which satisfies the inequality $4 > x > -2$ of the following is

(4 or –4 or –1 or –2)

9) If $x + 2 = 5$, where $\in \mathbb{Z}^-$, then the solution set of the equation is

($\varnothing$ or {3} or {–3} or 0)

10) The equation $x^2 + 3^2 = 9$ is of the degree. (second or third or fourth or fifth)

11) The measure of the angle of a circular sector whose area is $\frac{1}{4}$ the area of the circle is (360° or 180° or 270° or 90°)

12) 2 |–13| (> or = or ≥ or <)

2 Complete the following:

13) The circumference of a circle = ... × π

14) The result of 5 + [(3 –1) + 2] is

15) $\frac{4^4 \times 4^3}{4^6}$ = ...

16) If x – 3 = 12, then x = ..., where $x \in \mathbb{Z}$

17) If the perimeter of one face of a cube is 40 cm, then is lateral area = ... cm^2

18) When tossing a coin once, then the probability of getting a head = ...

19) The set of integers $\mathbb{Z} = \mathbb{Z}^+ \cup$ $\cup \mathbb{Z}^-$

20) The image of the point (1 , –2) by translation (..... , ...) is the point (0 , 0)

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Final Examinations from Different Governorates 2018/2019

3 Answer the following questions:

21) Find in $\mathbb{Z}$ the solution set of the equation $2x - 1 = -3$

.....

.....

22) If the lateral area of a cube is 36 cm^2, calculate its total area.

.....

.....

.....

23) Use the properties of multiplication in integers to calculate $4 \times (-33) \times 25$

.....

.....

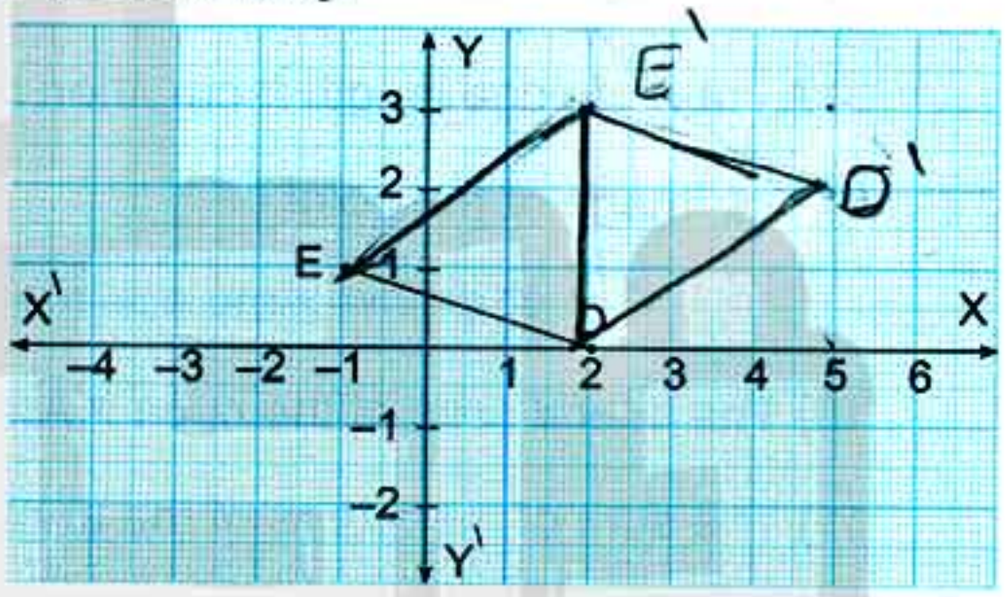
24) In the opposite coordinate plane, determine the following:

a) The image of $\overline{DE}$ where D (2 , 0) and E (–1 , 1) by translation $(x + 3, y + 2)$.

D' (5,2)
E' (2,3)

b) What is the name of the shape DD` E`E?

.....



25) The following table shows the number of students participating in the school activities.

Activities	Sports	Arts	Cultural
Percentage	45%	25%	30%

Represent the data above by the circular sectors.

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الصف السادس الابتدائى موقع ذاكرولى التعليمى كتاب Gem

11 Alexandria - East Educational Directorate

1 Choose the correct answer:

1) $\mathbb{Z} = \mathbb{N} \cup$ ($\{0\}$ or $\varnothing$ or $\mathbb{Z}^+$ or $\mathbb{Z}$)

2) $\{0\}$ $\mathbb{Z}$ ($\in$ or $\notin$ or $\subset$ or $\not\subset$)

3) If $x \in \{2, 5, -3\} \cap \{-5, -2, -3\}$, then x =..... (–5 or –3 or –2 or 2)

4) $(9)^2$ $(-3)^4$ (> or < or = or ≥)

5) (–7) (–|–5|) (> or < or = or ≥)

6) The solution set of the equation: $x - 2 = 3$ in $\mathbb{Z}$ is (5 or 1 or (5} or {3})

7) The number which satisfies the inequality $x + 4 > 2$ is (–1 or –2 or –3 or –4)

8) A cube of edge length 6 cm; then its lateral area = ... cm^2 (216 or 180 or 144 or 108)

9) The image of the point (..... , ...) by translation ($x - 3$, $y + 4$) is (–5 , –3).

((–8 , 15) or (–2 , 7) or (–8 , 7) or (–2 , –7))

10) The lateral area of the cube = Area of one face × (2 or 4 or 6 or height)

11) The sum of measures of the angles of the sectors around the centre of the circle = ... (100° or 150° or 180° or 360°)

12) If $\varnothing$ is empty set; then P ($\varnothing$) = ... (0 or 2 or 1 or 0.5)

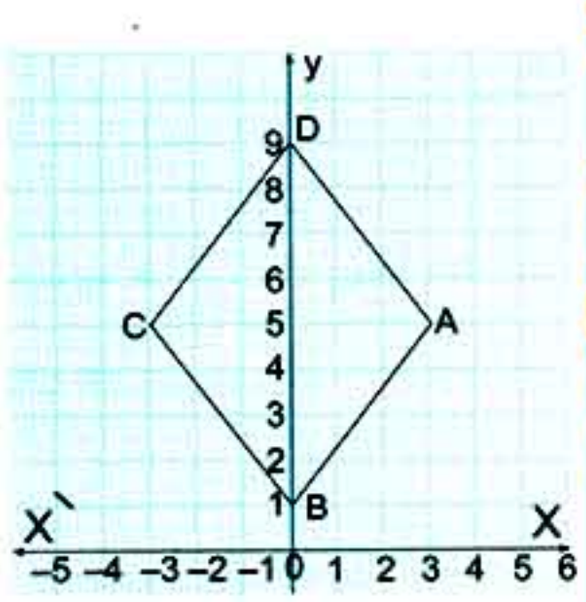
2 Complete the following:

13) |–5| + |7| = ...

14) 5 × (–3 + 7) = 5 × (–3) + 5 ×

15) In $\mathbb{N}$: $x + 4 < 7$, then S.S. = ...

In the opposite coordinate plane:



16) A (....., ...,)

17) The length of $\overline{AC}$ = ...units.

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18) If the lateral area of a cube is 100 cm^2, then its total area = ... cm^2

19) If the perimeter of the base of a cuboid is 10 cm, its height is 4 cm,
then its lateral area = ... cm^2

20) When tossing a die once, then the probability of getting the number 5 = ...

3 *Answer the following questions:*

21) **Arrange** the following numbers in ascending order: –9 , 17 , |–9| , –15 , 16

The order is , ... , ... , ... and

22) **Find** the result in the simplest form by using the basic laws of repeated multiplication:

$$\frac{(-5)^3 \times (-5)^2}{(-5)^4}$$

.....

.....

.....

23) A circle its diameter is 7 cm, **calculate** its surface area, where $\pi \simeq \frac{22}{7}$.

.....

.....

.....

RaNia SaYed

هذا العمل خاص بموقع ذاكرولى التعليمى ولا يسمح بتداوله على مواقع أخرى
الصف السادس الابتدائى موقع ذاكرولى التعليمى كتاب Gem

12 Menofia - Official Language Schools

1 Choose the correct answer:

1) If $3x = 27$, then x = ... (3 or 9 or 12 or 24)

2) The image of the point (3 , – 4) by translation (2 , –1) is

((1 , –3) or (5 , –5) or (6 , 4) or (–1, 3))

3) $(-2)^2$ $(3)^{zero}$ (< or > or = or ≤)

4) If a die is tossed once, then the probability of getting a prime number = ...

(0.2 or 0.5 or 0 or 1)

5) $\mathbb{Z}^+ \cup \{0\}$ = ... ($\mathbb{N}$ or $\mathbb{Z}^-$ or $\mathbb{Z}^+$ or $\mathbb{Z}$)

6) The ratio between the lateral area: the total area of the cube = ...

(1 : 2 or 1 : 3 or 2 : 3 or 3 : 1)

7) A cuboid with square base, its lateral area = 200 cm^2, and its height = 5 cm, then the side length of its base = ... cm (5 or 10 or 15 or 20)

8) $\{\frac{3}{9-4}\}$ $\mathbb{Z}$ ($\in$ or $\notin$ or $\subset$ or $\not\subset$)

9) If A = S, then P(A) = ... (0 or 1 or 0.5 or 0.3)

10) The measure of the central angle of a quarter of a circle is

(60° or 90° or 180° or 360°)

11) The number of lines of symmetry of a square = ... (0 or 1 or 2 or 4)

12) The number which verifies the inequality $2x + 1 < -1$ is (4 or –2 or 0 or –1)

2 Complete the following:

13) The number which if added to its twice, the result will be 9 is

14) $3 + |-3|$ = ...

15) The degree of the equation: $x^2 - 6 = 3$ is

16) The greatest non-positive integer number is

17) The sum of measures of the interior angles of a triangle = ...

18) The solution set of the equation: $x - 2 \leq 1 \in \mathbb{N}$ is

19) The additive inverse of $(-5)^2$ is

20) $\mathbb{Z}^+ \cap \mathbb{Z}^-$ = ...

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3 Answer the following questions:

21) Find the value of $\frac{2^4 \times (-2)^7}{(-2)^5 \times (-2)^2}$ (Show your steps.)

.....

.....

22) If the length of a cuboid box without a lid is 16 cm, its width is 7 cm and its height is 9 cm, calculate its lateral area and total area.

.....

.....

23) A square inscribed in a circle with radius 7 cm,

find the surface area of the shaded part $\left(\pi \simeq \frac{22}{7}\right)$



.....

.....

24) Find the solution set of the following, where $x \in \mathbb{Z}$.

a) $x + 8 = 19$

.....

.....

b) $1 - 2x > 5$

.....

.....

25) The following table shows the percentages of students who participated in school activities.

Activities	Sports	Social	Arts
Percentages	40%	35%	25%

Represent these data by circular sectors.

هذا العمل خاص بموقع ذاكرولى التعليمى ولا يسمح بتداوله على مواقع أخرى

الصف السادس الابتدائى موقع ذاكرولى التعليمى كتاب Gem

13 Gharbia - Directorate of Education

1 Choose the correct answer:

1) $\mathbb{Z} - \mathbb{N}$ = ... ($\mathbb{Z}^+$ or {0} or $\mathbb{Z}^-$ or 0)

2) The equation $2x^3 = 4$ is of the degree. (1^{st} or 2^{nd} or 3^{rd} or 4^{th})

3) The image of the point A (– 4 , 3) by translation (–1 , – 4) is

((–5 , 7) or (–5 , –1) or (–7 , 3) or (–3 , –1))

4) Two consecutive natural numbers, the smaller one is x, then the greater is

($2x$ or $x + 1$ or $2x + 1$ or $x - 1$)

5) $(3)^0 + (-3)^0$ = ... (6 or 0 or 1 or 2)

6) A circle of diameter 8 cm, its area = ... cm^2 (9π or 8π or 16π or 64π)

7) If: $x \in \mathbb{N}$, then the S.S. of the inequality $-x > 3$ is

({4 , 5 , ...} or {3} or {– 4 , – 5 , – 6} or $\varnothing$)

8) A basket contains cards numbered from 1 to 20. If a card is drawn randomly, then the probability that the number written on it is divisible by 6 = ...

($\frac{3}{20}$ or $\frac{4}{20}$ or $\frac{5}{20}$ or $\frac{6}{20}$)

9) The additive inverse of (–5) is (–10 or $\frac{1}{-5}$ or |–5| or 0)

10) The probability of success of a student is 70%, then the probability of his failure is

(0.7 or 0.07 or 0.3 or 0.03)

11) The area of one face of the cube = ... its total area. ($\frac{1}{2}$ or $\frac{1}{8}$ or $\frac{1}{6}$ or $\frac{1}{4}$)

12) The S.S. of the inequality $-2x < 0$ in $\mathbb{Z}$ is ($\mathbb{N}$ or $\mathbb{Z}$ or $\varnothing$ or $\mathbb{Z}^+$)

2 Complete the following:

13) The lateral area of a cube = ... ×

14) If five times of a number equals 60, then the number is

15) The image of the point (–1 , 2) by translation (2 , –2) is

16) A circle, its circumference is 62.8 cm, then its area = ... cm^2, where ($\pi = 3.14$)

17) $|-1| \times (-4)$ = ...

18) The lateral area of a cuboid with base in the shape of a square with side length 8 cm and height 5 cm = ... cm^2

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19) $(-5)^2 \times (5)^3 = 5$

20) If the sum of edge lengths of a cube is 24 cm, then its lateral area = ... cm^2

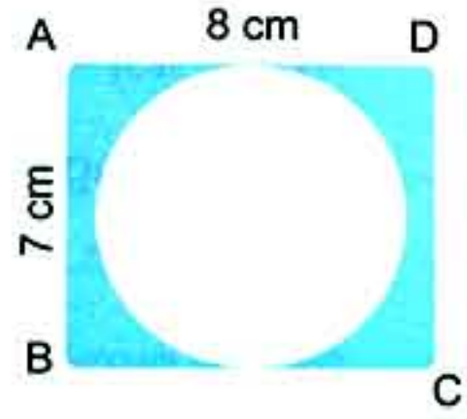
3 Answer the following questions:

21) Find the value of: $\frac{(8)^3 \times (8)^5}{(-8)^8}$

.....

.....

22) In the opposite figure: If ABCD is a rectangle, whose length = 8 cm, and width = 7 cm, then calculate the area of the shaded part $\left(\pi \simeq \frac{22}{7}\right)$



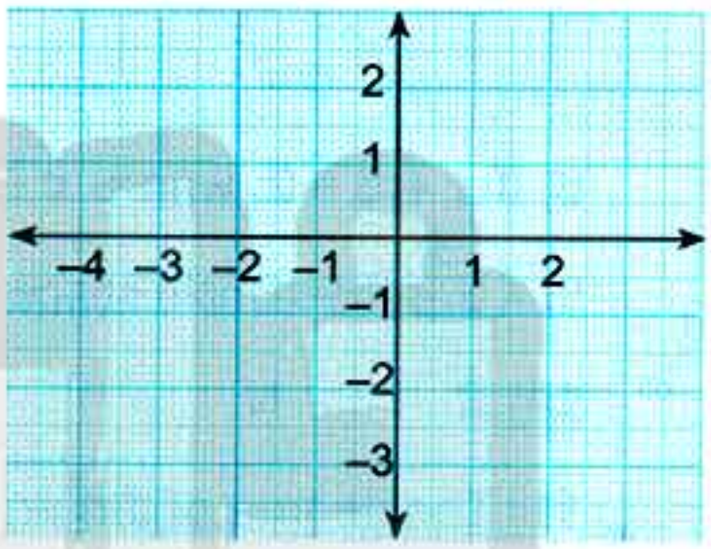
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23) Draw Δ ABC, where

A (1 , 1), B (–3 , –1)

and C (0 , –5)



24) In an experiment of throwing a fair die once and observing the number on the upper face, find: the probability of each of the following events:

1) Getting a number greater than 6 = ...

2) Getting a prime number = ...

25) The following table shows the percentages of the production of chickens on four farms within one month: Represent by pie chart.

Farms	1st	2nd	3rd	4th
Percentage	10%	35%	30%	25%

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14 Kafr El-Sheikh - Kafr El-Sheikh Educational Directorate

1 Choose the correct answer from those given:

1) The additive identity element in $\mathbb{Z}$ is (1 or –1 or 0 or 10)

2) When tossing a coin once, the probability of getting a head = ... (Zero or 2 or 1 or 0.5)

3) represents an inequality. ($x > 7 - 5$ or $3x + 2 = 11$ or $2x = 24$ or $\frac{x}{5} = 4$)

4) $-|-45|$ = ... (45 or – 45 or |45| or |– 45|)

5) The image of the point (–1,2) by translation of magnitude 3 units in the positive direction of x-axis is ((–3, 0) or (2 , 2) or (–2 , 2) or (–1 , 3))

6) The number which satisfies the inequality: $2x + 1 \leq -1$ (4 or 2 or 0 or –1)

7) If the total surface area of the cube is 726 cm^2, then its lateral surface area = ... cm^2 (484 or 121 or 242 or 181.5)

8) If $x + 6 = 2$, where $x \in \mathbb{Z}$, then x = ... (4 or – 4 or 12 or –12)

9) If S is the sample space of a random experiment, then P(S) = ... (zero or 2 or 1 or 0.8)

10) $\mathbb{Z}^+$ N ($\subset$ or $\not\subset$ or $\in$ or $\notin$)

11) The degree of the equation $x^3 - 4x^2 = 0$ is (first or second or third or fourth)

12) The total surface area of the cube = area of one face × (12 or 4 or 3.14 or 6)

2 Complete each of the following:

13) is neither positive nor negative.

14) The surface area of the circle = π ×

15) The perimeter of the base of a cube is 24 cm, then its total area is cm^2.

16) If $\{2 , x\} \cup \{-4 , 0 , 4\} = \{0 , 2 , -2 , -4 , 4\}$, then x = ...

17) A ball was selected without looking from a box that contains 8 white balls and 12 red balls, then the probability of selecting a white ball = ...

18) The image of the point (8 , –10) by translation (–3 , 4) is

19) If $\frac{x}{5} = 4$, then x =.....

20) The lateral surface area of the cuboid = perimeter of the base ×

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3 Answer the following:

21) Use the distributive property to **find** the value of:

$63 \times 85 + 63 \times 15$

.....

.....

.....

22) **Find** the solution set of the inequality $3x + 2 \leq 11$ in $\mathbb{Z}$:

.....

.....

.....

23) A cuboid shaped box with a square base its side length is 9 cm and its height is 20 cm. **Calculate** its lateral area and its total area.

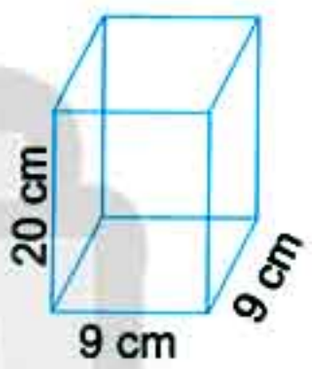
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24) Nahid is a clerk in an institution, she contributes with her husband by her salary as shown in the following table:.

House rent	Food	Savings
25%	50%	25%

Represent these data by circular sectors.

25) A circle of diameter length 12 cm. **Calculate** its surface area. ($\pi \simeq 3.14$)

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15 Damietta - Official Language Schools

1 Choose the correct answer:

1) $\mathbb{Z} \cap \mathbb{N}$ = ... ($\mathbb{Z}$ or $\mathbb{Z}^+$ or {0} or $\mathbb{N}$)

2) The equation: $x^3 + 4 = 5$ is of the degree.
(first or second or third or fourth)

3) A circle, its radius is 4 cm, then its area =..... π cm^2 (4 or 8 or 12 or 16)

4) The image of the point (–3 , 5) by translation $(x + 1, y - 2)$ is
((– 4 , 3) or (–2, 3) or (–2 , –3) or (2 , 3))

5) If a fair die is tossed once, then the probability of getting an odd number = ...
$\left(0 \text{ or } 1 \text{ or } \frac{1}{3} \text{ or } \frac{1}{2}\right)$

6) $|-4| - |4|$ (zero or 1 or 8 or –8)

7) All the following numbers satisfy the inequality $x > -3$ except
(zero or – 4 or –1 or 2)

8) The sum of edge lengths of a cube is 96 cm, then its lateral area = ... cm^2
(8 or 64 or 256 or 384)

9) A circular sector represents $\frac{1}{3}$ of a circle, then the measure of its central angle = ... °
(90 or 120 or 180 or 270)

10) If $3x = -9$, then: $x \in$ ($\mathbb{N}$ or $\mathbb{Z}^+$ or $\varnothing$ or $\mathbb{Z}^-$)

11) $(-1)^8 + (-1)^9 + (-1)^{zero}$ = ... (zero or –1 or 1 or 2)

12) The solution set of the inequality: $2 \leq x < 3$ where $x \in \mathbb{N}$ is
({zero} or {2} or {3} or {2 , 3})

2 Complete the following:

13) $\frac{(-2)^7 \times (-2)^5}{2^{10}}$ = ...

14) If: $x - 3 = |-7|$, then x = ...

15) If: x (-3 , 2), y (–3 , –4), then the length of $\overline{xy}$ = ... units.

16) The height of a cuboid whose lateral area is 160 cm^2 and dimensions of its base are 7 cm and 3 cm = ... cm.

17) A box contains 5 white balls, 3 blue balls and 8 red balls, all of them are symmetric, one ball is drawn from the box at random, then the probability that the drawn ball is red = ...

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18) The multiplicative identity element in $\mathbb{Z}$ is

19) The image of the point (–1 , 2) by translation of magnitude of 3 units in the positive direction of Y-axis is

20) The surface area of the circle = ...

3 Answer the following:

21) **Find** the solution set of inequality: $3x - 2 \geq 4$, where $x \in \mathbb{Z}$.

.....

.....

22) Use the properties of addition and subtraction in $\mathbb{Z}$.

Find: 115 + 390 + (–115) (Write the used property.)

.....

.....

23) A cube of edge length 12 cm. **Find** the total area.

.....

.....

24) A circle whose diameter is 14 cm, **calculate** its area $\left(\text{where } \pi \simeq \frac{22}{7}\right)$.

.....

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25) The following table shows the rate of the score of 200 students in one school of Cairo Governorate.

Rate	Excellent	Good	Pass	Weak
Percentage	15%	50%	25%	10%

Represent these data by circular sector.

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الصف السادس الابتدائى موقع ذاكرولى التعليمى كتاب Gem

16 Sharkia - Sharkia Educational Directorate

1 Choose the correct answer:

1) $(-1)^{105} + (-1)^{20}$ = ... (2 or 1 or –1 or zero)

2) If $x + 2 = |-5|$, then x = ... (–7 or 7 or 3 or –3)

3) If $x \in \{2, -3\} \cap \{5, -3\}$, then x = ... (–2 or –1 or 3 or –3)

4) If a fair die is tossed once, then the probability of the appearance of the number 5 = ...
(zero or $\frac{1}{6}$ or $\frac{5}{6}$ or 1)

5) $3^2 + 3^2 + 3^2$ = ... (3^6 or 9^2 or 3^3 or 9^6)

6) If $2x = -4$, $x \in \mathbb{Z}$, then the set of solution is
({2} or {–2} or {4} or {– 4})

7) The image of the point (– 4 , 3) by translation (–1 , – 4) is
((–5 , 7) or (–5 , –1) or (–7 , 3) or (–3 , –1))

8) $\mathbb{Z}^+ \cap \mathbb{Z}^-$ = ... (zero or 1 or –1 or ∅)

9) The sum of the measures of all angles accumulative at the centre of a circle equals
(90° or 108° or 180° or 360°)

10) The number which satisfies the inequality $x > -2$ is (–1 or –2 or –3 or –4)

11) If $x = |-2|$, y = –3, then x y = ... (5 or –5 or 6 or –6)

12) The total area of the cube with 3 cm edge length = ... cm^2 (12 or 27 or 36 or 54)

2 Complete the following:

13) $(-5) \times [7 + (-5)]$ = ... (in the simplest form)

14) The degree of the equation: $3x^2 + 4x - 1 = 0$ is

15) A circle of diameter length 8 cm, then its area = ... π cm^2.

16) $7^0 + (-7)^0$ = ...

17) The additive inverse of $(-8)^0$ is

18) The greatest negative integer is

19) At throwing a fair die and observing the upper face, then the probability of getting a number greater than 6 equals

20) $\frac{a^m}{a^n} = a^{.....}$ (where m , n $\in \mathbb{Z}^+$, m ≥ n)

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3 Answer the following:

21) Find the result of: $\frac{(2)^5 \times (-2)^3}{(-2) \times (2)^4}$

.....

.....

22) A cuboid, its length is 6 cm, its width is 4 cm and its height is 8 cm, find:

1) The lateral area. **2)** The total area.

.....

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23) a) Find the solution set of the inequality: $x + 3 < 5$ (where $x \in \mathbb{Z}$).

.....

.....

b) Find the solution set of the equation: $2x + 1 = -9$ in $\mathbb{Z}$.

.....

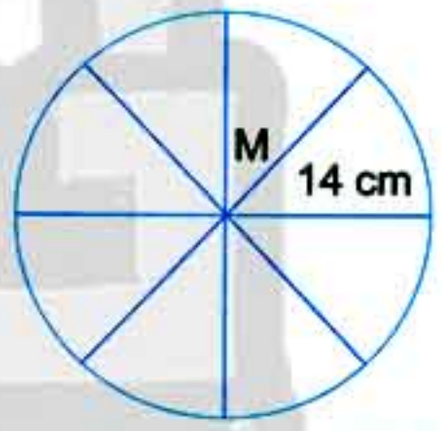
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24) In the opposite figure:

M is a circle of radius length 14 cm is divided into 8 equal circular sectors. Find:

1) The surface area of the circle M.

2) The area of one circular sector. $\left(\pi \simeq \frac{22}{7}\right)$



.....

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25) The following table shows the percentage of the production of a factory of electric sets (4 kinds):

Kinds of the sets	TV	Washing machine	Refrigerator	Cooker
Amount of the production	35%	25%	15%	25%

Represent these data by pie charts.

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الصف السادس الابتدائى موقع ذاكرولى التعليمى كتاب Gem

17 Port Said - Mathematics Inspection

1 Choose the correct answer:

1) The circumference of a circle = π × (r or r^2 or 2r or 3.14)

2) If $-2x = 10$, then $x \in$ ($\mathbb{N}$ or $\varnothing$ or $\mathbb{Z}^+$ or $\mathbb{Z}^-$)

3) The number which satisfies the inequality $x - 2 > 3$ is (–1 or –2 or 6 or 4)

4) $(-1)^8 + (-1)^9$ = ... (zero or –1 or 1 or 2)

5) $|5 - 11|$ $\mathbb{Z}$ ($\notin$ or $\in$ or $\subset$ or $\not\subset$)

6) $2^5 \times 2^2$ = ... (2^7 or 2^4 or 2^3 or 1)

7) When tossing a die, the probability of getting a number on the upper face more than 6 = ... ($\varnothing$ or zero or 1 or 2)

8) $|-3|$ = ... (3 or –3 or $-|3|$ or 3 – 3)

9) The total area of a cube = area of one face × (4 or 5 or 6 or 8)

10) The probability of impossible event = ... ($\varnothing$ or zero or 1 or 2)

11) The image of the point (2 , 3) by translation (x + 1, y + 2) is
((3 , 4) or (3 , 5) or (4 , 3) or (5 , 3))

12) If $x + 6 = 2$, $x \in \mathbb{Z}$, then x = ... (4 or $|-4|$ or –4 or $|4|$)

2 Complete the following:

13) $3 + |-3|$ = ...

14) The perimeter of the base of a cuboid is 10 cm and its height is 4 cm, then its lateral area = ...

15) The probability of the sure event = ...

16) The sum of measures of all accumulated angles of the sectors at the centre of a circle = ...

17) The area of the circle = ... × π.

18) If the total area of a cube is 150 cm^2, then the length of its edge is cm.

19) $\mathbb{Z}^+ \cup \{0\}$ = ...

20) If $3x = 9$, then x = ...

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Final Examinations from Different Governorates 2018/2019

3 Answer the following:

21) Find the result of $(4 \times 3^2 \times 3^2) - 7 \times 3$

.....

.....

.....

22) In the coordinate plane, locate the points A (0 , 1), B (4 , 3), C (4 ,7), then find:

1) The length of $\overline{BC}$ = ... units

2) The image of Δ ABC by translation (0 , −4)

23) Find the solution set of the inequality $x - 2 \geq 3$, where $x \in \mathbb{Z}$, then represent it on the number line.

.....

.....

.....

24) A cuboid-shaped box with a square base, its length is 10 cm and its height is 7 cm.

Calculate the lateral area.

.....

.....

.....

25) The following table shows the percentage of the production of a factory of house electric sets.

Kinds of sets	Washing machine	Heater	Oven	Mixer
Percentage	30%	15%	40%	15%

Represent these data by circular sectors.

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18 Ismailia - Directorate of Education

1 Choose the correct answer:

1) $\mathbb{Z} - \mathbb{N}$ = ... ($\mathbb{Z}^+$ or $\mathbb{Z}^-$ or zero or $\mathbb{N}$)

2) The probability of the certain event = ... (zero or 1 or 5 or $\frac{1}{2}$)

3) The image of the point (3 , 5) by translation (2 , –1) is ((5 , 6) or (5 , 4) or (1 , 4)or (1 , 6))

4) The sum of the measures of all the central angles of the sectors around the centre of the circle is (90° or 80° or 270° or 360°)

5) If $x = |-2|$, y = –3, then xy = ... (–5 or 5 or –6 or 6)

6) The degree of the equation: $x^2 + 3 = 4$ is of the degree. (first or second or third or fourth)

7) If the area of one face of a cube is 25 cm^2, then its lateral area = ... cm^2 (150 or 20 or 25 or 100)

8) If $2x = 10$, $x \in \mathbb{N}$, then x = ... (3 or 4 or 5 or 6)

9) $(3)^{zero} + (-3)^{zero}$ = ... (6 or 0 or 1 or 2)

10) All the following numbers satisfy the inequality $x > -3$ except (0 or – 4 or –1 or –2)

11) A circle, its diameter length is 6 cm, then its surface area = ... cm^2 (3 π or 6 π or 9 π or 36 π)

12) The distance between two points A (–3 , 2) and B (2 , 2) = ... length units (–5 or 2 or 5 or 1)

2 Complete the following:

13) The greatest negative integer number is

14) The probability of getting a head when tossing a regular coin once is

15) The ratio between the lateral area of a cube and its total area = ... :

16) If the sum of all edge lengths of a cube is 144 cm, then its total area = ... cm^2

17) If $x - 2 = |-4|$, then x = ...

18) The multiplicative identity element in $\mathbb{Z}$ is

19) If the base of a cuboid is in the shape of a square of side length 10 cm and its height is 7 cm, then its lateral surface area = ... cm^2

20) A circle's circumference is 88 cm, then its area = ... cm^2 $(\pi = \frac{22}{7})$

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3 Answer the following:

21) a) Simplify: $\frac{7^5 \times 7^3}{7^6}$

.....

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b) Use the properties to **find** the result: 116 + 190 + (–116)

.....

.....

22) **Find** the solution set of the equation: $2x + 1 = -13$ in $\mathbb{Z}$.

.....

.....

23) A cuboid's length is 6 cm, its width is 4 cm and its height is 8 cm. **Find** its lateral area and total area.

.....

.....

24) A box contains 10 identical balls numbered from 1 to 10, one ball is drawn at random, write the sample space, then **find** the probability that the drawn ball has:

1) An odd number

2) A number divisible by 3

3) An even prime number

4) A number more than 6

.....

.....

25) **Draw** Δ ABC on a squared lattice, where A (4 , 4), B (0 , 2) and C (6 , –2), then **find** its image by translation $(x - 4, y + 1)$.

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الصف السادس الابتدائى موقع ذاكرولى التعليمى كتاب Gem

19 Suez - South of Suez Directorate

1 Choose the correct answer:

1) When tossing a die once, the probability of getting a number on its upper face more than 6 = ... (zero or $\frac{1}{6}$ or $\frac{1}{3}$ or $\varnothing$)

2) {0} $\mathbb{N}$ ($\subset$ or $\not\subset$ or $\in$ or $\notin$)

3) The equation $x^2 + 3 = 8$ is of the degree. (first or second or third or fourth)

4) $|-5|$ 5 ($\geq$ or = or > or <)

5) $(-1)^8 + (-1)^9$ = ... (–1 or zero or 1 or 2)

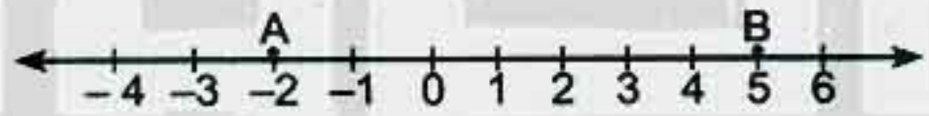
6) The sum of the measures of the accumulative angles at a point = ...° (90 or 180 or 270 or 360)

7) If $2x = -6$, then $x \in$ ($\mathbb{N}$ or $\varnothing$ or $\mathbb{Z}^+$ or $\mathbb{Z}^-$)

8) $\frac{1}{7^5} \times 7^5$ 1 (≥ or = or > or <)

9) The total area of the cube = area of one face X (2 or 4 or 6 or 8)

10) AB = ... units



(8 or 7 or 5 or –2)

11) $5 \times (-4)$ = ... (–20 or 20 or 9 or –1)

12) The image of the point (–3 , 4) by translation $(x , y - 4)$ is

((–3 , 0) or (–7 , 4) or (–3 , 8) or (–1 , 4))

2 Complete the following:

13) $\mathbb{Z} - \mathbb{N}$ = ...

14) The circumference of the circle = ... × π

15) $\frac{2^2 \times 2^5}{2^2}$ = ...

16) If $x + 6 = 2$, $x \in \mathbb{Z}$, then x = ...

17) The lateral area of the cuboid = perimeter of the base ×

18) A cube of edge length 10 cm, then its lateral area = ...

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19) = (length + width) × 2

20) A box contains 5 white balls, 3 blue balls and 8 red balls all of them are symmetric. One ball is drawn from the box at random. Then the probability that the drawn ball is red = ...

3 *Answer the following:*

21) Use the properties of addition in $\mathbb{Z}$ to find the result of:

$(-7) + 19 + 17$ (state the property used in each step)

.....

.....

.....

22) Find the solution set of the following inequality in $\mathbb{Z}$: $x - 2 \leq 3$

.....

.....

.....

23) A circle its radius is 7 cm, calculate its surface area $\left(\text{where } \pi \simeq \frac{22}{7}\right)$.

.....

.....

.....

24) A cuboid-shaped box with a square base, its length is 10 cm, its height is 7 cm. Calculate the lateral area.

.....

.....

.....

25) The following table shows the percentages of the production of a factory of house electrical sets.

Kinds of sets	Washing machine	Heater	Oven	Mixer
Percentage	25%	15%	40%	20%

Represent these data using circular sectors.

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20 Fayoum - Directorate of Education

1 Choose the correct answer:

1) $\mathbb{N} \cup \mathbb{Z}$ ($\mathbb{Z}^+$ or $\mathbb{Z}^-$ or $\mathbb{Z}$ or $\mathbb{N}$)

2) All the following numbers satisfy the inequality $x > -3$ except (0 or –2 or –1 or –4)

3) $(-1)^{11} + (-1)^{10}$ = ... (zero or –1 or 1 or 2)

4) If $\frac{x-1}{2} = 3$, $x \in \mathbb{Z}$, then x = ... (5 or 7 or –7 or 6)

5) $|-7| + 3$ $|-7 + 3|$ (> or = or < or ≠)

6) The additive inverse of $(-3)^0$ is (3 or –3 or 1 or –1)

7) If $x = 4$, $y = -3$, then the negative number of the following is

($x + y$ or $x - y$ or xy or y^x)

8) The image of the point (4 , –3) by translation ($x - 3$, Y + 3)

is ((–7 , –6) or (1 , 0) or (0 , 1) or (7 , 6))

9) The probability of appearing a head when tossing a coin once = ... $\left(\text{zero or 2 or 1 or } \frac{1}{2}\right)$

10) If the probability of success of a student in mathematics is 75%, then the probability of his failure = ... $\left(25 \text{ or } 0.35 \text{ or } 1 \text{ or } \frac{1}{4}\right)$

11) The ratio between the lateral surface area and the total surface area of a cube =.....

(2 : 3 or 3 : 4 or 6 : 4 or 1 : 2)

12) The total surface area of a cuboid = 100 cm^2 and the area of one base is 20 cm^2, then its lateral surface area = ... cm^2. (40 or 60 or 80 or 140)

2 Complete the following:

13) The degree of the equation $x^3 + 3x^2 + x + 4 = 11$ is the degree.

14) The solution set of the inequality $x \leq 0$ in $\mathbb{N}$

15) The solution set of $x + 6 = 5$ in $\mathbb{N}$ = ...

16) If the perimeter of one face of a cube is 20 cm, then its total surface area = ... cm^2

17) On the coordinates plane if the point A represents (–2 , 4) and the point B represents (5 , 4), then the length of $\overline{AB}$ = ... units.

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18) A cuboid its lateral area is 120 cm^2, its length is 5 cm and its width is 4 cm, then its height = ... cm.

19) $\frac{\text{Circumference of the circle}}{2\pi}$ = ...

20) ≤ the value of probability of any event ≤

3 Answer the following:

21) **Find the result:** $\frac{(-5)^5 \times (-5)^4}{(-5)^7}$

22) **Find** the solution set of the following equation in $\mathbb{Z}$: 3 $(x + 2) = 3$.

.....

.....

23) **Calculate** the area of a circle with radius 10 cm. ($\pi \simeq 3.14$)

.....

.....

24) A box in the shape of a cuboid, its length 10 cm, width 5 cm and height is 8 cm.

Find its lateral surface area and its total surface area.

.....

.....

.....

25) The following table shows the percentage of the favourite sports in a school.

Types of the sports	Football	Basketball	Handball
Percentage of students numbers	40%	35%	25%

Represent these data by the circular sectors.

.....

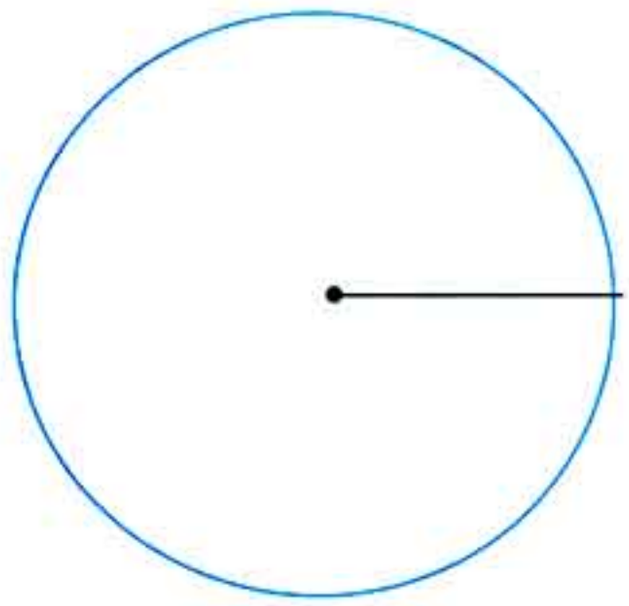
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21 Assuit – Directorate of Education

1 Choose the correct answer:

1) $|-9| + 3$ $\mathbb{Z}$ ($\in$ or $\notin$ or $\subset$ or $\not\subset$)

2) is the multiplicative identity (neutral) in $\mathbb{Z}$ (2 or 1 or Zero or 3)

3) The number which satisfies the inequality $x > -2$ is (-1 or -4 or -3 or -2)

4) A fair die is thrown once, then the probability of appearing the number greater than 6 = ... (zero or 2 or 1 or 0.5)

5) If $2x + 9 = 5$ where $x \in \mathbb{Z}$, then x = ... (-4 or 4 or 2 or -2)

6) When tossing a die once, then the probability of getting a number divisible by 3 equals = ... (zero or $\frac{1}{3}$ or $\frac{1}{2}$ or 1)

7) $2^6 \times 2^2$ = ... (2^3 or 2^4 or 2^8 or 2^{12})

8) The lateral area of a cuboid is 130 cm^2 and the perimeter of its base is 26 cm, then the height = ... cm (5 or 6 or 9 or 10)

9) x is greater than or equal to 3, the symbolic expression of this situation is
($x > 3$ or $x < 3$ or $x \leq 3$ or $x \geq 3$)

10) A circle its diameter length is 14 cm, then its surface area = ... cm^2. (where $\pi \simeq \frac{22}{7}$)
(49 or 21 or 154 or 7)

11) A cube of total area 150 cm^2 the length of the edge is cm. (5 or 25 or 50 or 125)

12) The solution set of equation $2x = 6$ in $\mathbb{N}$ is ({3} or {–3} or {12} or {–12})

2 Complete the following:

13) $\mathbb{Z}^+ \cap \mathbb{Z}^-$ = ...

14) If $3y = 6$, then $5y$ = ...

15) A circle of diameter length 10 cm, then its area = ... π cm^2.

16) The image of the point (3 , 5) by translation (X + 2, y – 1) is

17) If the perimeter of one face of a cube = 24 cm, then its total area = ... cm^2.

18) The distance between two points A (–3 , 2) and B (2 , 2) = ... length units.

19) The equation $x^2 + 3 = 4$ is of the degree.

20) When tossing a die once, then probability of getting a number on the upper face more than 5 = ...

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3 Answer the following:

21) **Find** the solution set of the following inequality:

$3x - 2 < 7$ where $x \in \mathbb{N}$

.....

.....

22) Use the properties of addition in $\mathbb{Z}$ to **find** the result of:

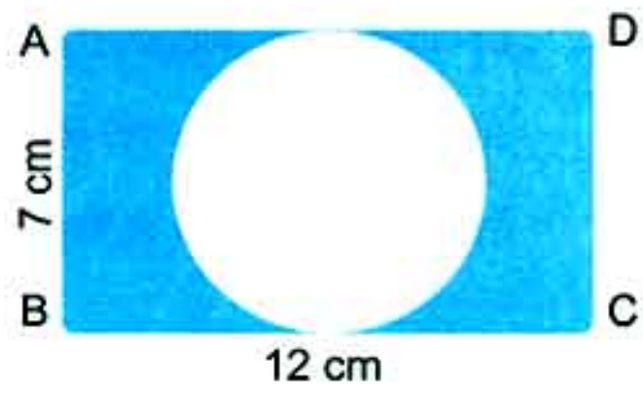
(–116) + 190 + 116 (State the property used in each step.)

.....

.....

23) In the opposite figure:

ABCD is a rectangle, its length 12 cm and its width 7 cm. A circle is drawn to touch the sides $\overline{AD}$ and $\overline{BC}$.



Calculate the area of the shaded part. $\left(\text{where } \pi \simeq \frac{22}{7}\right)$

.....

.....

24) The following table shows the number of students participating in school activities.

Activity	Culture	Sport	Social	Art
Percentage	20%	40%	25%	15%

Represent these data by circular sectors.

25) On a coordinate plane, **draw** line segment $\overline{AB}$ where: A (2 , 3), B (–2 , 0), then **find** its image by translation ($x + 3$, $y - 2$).

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22 Qena - Qeft Educational Directorate

1 Choose the correct answer:

1) $\mathbb{Z}^+ \cap \mathbb{Z}^-$ = ... ($\mathbb{N}$ or $\varnothing$ or $\mathbb{Z}^+$ or $\mathbb{Z}^-$)

2) 19 – (–11) = ... (8 or –8 or 30 or –30)

3) $2^3 + 2^2$ =..... (2^5 or 4^5 or 12 or 2)

4) If $x + 5 > 2$, then $x >$ (–2 or –3 or –5 or –7)

5) If $2x = -6$, then $x \in$ ($\mathbb{N}$ or $\varnothing$ or $\mathbb{Z}^+$ or $\mathbb{Z}^-$)

6) The circumference of a circle = ... × π (r or 2r or r^2 or r+2)

7) The number which satisfies the inequality $x - 2 > 3$ is (3 or 4 or 5 or 6)

8) The edge length of a cube is 6 cm, then its lateral area = ... cm^2
(144 or 216 or 24 or 36)

9) The image of the point (–3 , 1) by translation (3 , 2) is
((0 , 1) or (0 , 3) or (3 , 0) or (1 , 0))

10) The sum of the measures of all angles accumulated at the centre of a circle equals ° (630 or 180 or 306 or 360)

11) If a fair die is thrown once, then the probability of appearing an even number equals (zero or 2 or 1 or 0.5)

12) {0} $\mathbb{N}$ ($\in$ or $\notin$ or $\subset$ or $\not\subset$)

2 Complete the following:

13) $5^7 \div (-5)^6$ = ...

14) If $4x + 3 = 23$, then x = ...

15) $\left|\frac{5-11}{3}\right|$ = ...

16) 54 × 117 – 54 × 17 = ... × (..... –) (Use the distributive property.)

17) The circle whose diameter length is 14 cm, then the surface area = ... cm^2 $\left(\pi \simeq \frac{22}{7}\right)$

18) The total area of a cube = the area of one face ×

19) The additive identity is, the multiplicative identity is

20) The set of counting numbers $\mathbb{N}$.

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3 Answer the following questions:

21) **Find** the value of: $\frac{2^5 \times (-2)^3}{2^4 \times (-2)}$

.....

.....

.....

22) **Find** the S.S. of the inequality: $2x + 9 \leq 1$ and represent it on the number line if

1) $x \in \mathbb{N}$ **2)** $x \in \mathbb{Z}$

.....

.....

.....

23) A cuboid, its length is 6 cm, its width is 4 cm and its height is 8 cm, **find**:

1) Its lateral area. **2)** Its total area.

.....

.....

.....

24) A box contains 8 white balls, and 12 red balls where all balls are identical. If a ball is drawn randomly, **calculate** the probability of the following:

1) Drawing a white ball. **2)** Drawing a red ball.

.....

.....

.....

25) **Represent the following data by circular sectors.**

Farm	First	Second	Third
Percentage	25%	35%	40%

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23 Sohag - City Private Schools

1 Choose the correct answer:

1) {15} $\mathbb{Z}^-$ ($\in$ or $\notin$ or $\subset$ or $\not\subset$)

2) The probability of getting an odd number when tossing a die once = ...

(zero or 2 or 1 or $\frac{1}{2}$)

3) The number which satisfies the equation $x - 2 = 3$ is (3 or 4 or 5 or 6)

4) $(-1)^{100} + (-1)^{101}$ = ...

(zero or –2 or –3 or –4)

5) A cube of lateral area 36 cm^2, then its total area = ... cm^2

(36 or 54 or 9 or 45)

6) The image of the point (4 , 6) by translation $(x + 1\ y - 3)$ is

((5 , 7) or (6 , 5) or (2 , 5) or (5 , 3))

7) The degree of the equation $3x^3 - 3 = 16$ is (first or second or third or fourth)

8) If $3x$ = zero, then x = ... (3 or zero or 1 or –3)

9) $\mathbb{Z}^+ - \mathbb{Z}^-$ = ... ($\mathbb{Z}$ or $\mathbb{N}$ or $\varnothing$ or $\mathbb{Z}^+$)

10) The multiplicative identity in $\mathbb{Z}$ is (zero or 1 or –1 or 2)

11) If the diameter of a circle = 14 cm, then its area = ... cm^2 $(\pi \simeq \frac{22}{7})$

(144 or 451 or 154 or 44)

12) When tossing a die once, then the probability of getting number 3 = ...

(zero or $\frac{3}{6}$ or $\frac{1}{2}$ or $\frac{1}{6}$)

2 Complete the following:

13) The probability of getting a tail when tossing a coin once = ...

14) $(-3) + |-3|$ = ...

15) $\frac{6^4 \times 6^5}{6^7}$ = ...

16) If X = (–2 , 1), Y = (–2 , 5), then the length of $\overline{XY}$ = ...

17) The area of the opposite figure = ... ($\pi \simeq 3.14$)



18) The numbers lying between – 5 and 0 are

19) $\mathbb{Z}^+ \cup \{0\}$ = ...

20) The greatest negative integer is

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3 Answer the following:

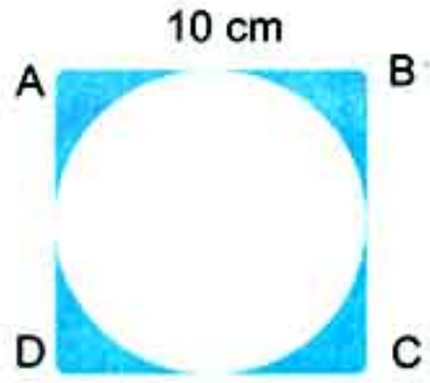
21) Find the solution set of $3x + 1 > -5$ (where $x \in \mathbb{Z}$)

.....

.....

.....

22) In the opposite figure if ABCD is a square whose length = 10 cm, calculate the area of the shaded part.



.....

.....

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.....

23) A box without a lid is in the shape of a cuboid, its length is 16 cm, its width is 7 cm and its height is 19 cm. Calculate its lateral area.

.....

.....

.....

.....

24) By using the distribution property, find: $(-11) \times [5 + (-3)]$

.....

.....

.....

25) The following table shows the percentage of the favourite sports for your class students:

Favourite sports	Football	Volleyball	Basketball	Ping-pong
Percentage	40%	20%	10%	30%

Represent these data by circular sectors.

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24 Luxor - Al-Salam Language School

1 Choose the correct answer:

1) When tossing a coin once, then the probability of getting a head is
(0 or2 or1 or0.5)

2) $(-19)^0 + (19)^0$ = ...
(–1 orzero or1 or2)

3) The image of the point (3 , 5) by translation (2 , –1) is ((2 , 6) or(5 , 4) or(1 , 4) or(1 , 6))

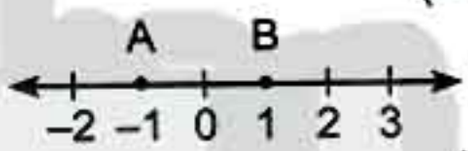
4) The equation: $x^2 + 3 = 4$ is of the degree. (first or second orthird orfourth)

5) The smallest positive integer is
(0 or1 or–1 or2)

6) The perimeter of the base of a cuboid is 10 cm, its height is 4 cm its lateral area =
..... cm^2.
(30 or40 or50 or60)

7) If $x + 2 = |-5|$, then x = ...
(–7 or7 or3 or–3)

8) The distance between the point A and B = ...



(2 or3 or4 or5)

9) –7 2
(> or< or= or≤)

10) The solution set of the equation: $x + 2 = -5$ in $\mathbb{Z}$ is {.....} (–3 or–7 or–8 or–9)

11) The number which satisfies the inequality: $x < -1$ is
(0 or1 or3 or–2)

12) The sum of measures of all the central angles of the sectors about the centre of the circle = ... °.
(90 or180 or270 or360)

2 Complete the following:

13) $\mathbb{Z}^+ \cap \mathbb{Z}^-$ = ...

14) If the sum of edges of a cube is 48 cm, then its edge length = ... cm

15) Probability of the impossible event = ...

16) If $x + 2 > 5$, then $x >$

17) The lateral area of a cuboid = perimeter of a base ×

18) The solution set of the equation: $x + 2 = 6$ in $\mathbb{N}$ = {.....}

19) The image of the point (..... , ...) by translation (3 , 1) is (5 , 3).

20) Area of the circle = ...

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3 Answer the following:

21)Find the result in the simplest form: $\frac{2^3 \times 2^4}{2^7}$

.....

.....

.....

22)Find the solution set of the following inequality: $2x + 1 \geq 5$ in $\mathbb{Z}$.

.....

.....

.....

23) A circle of diameter 14 cm,**calculate** its area. $\left(\pi \simeq \frac{22}{7}\right)$

.....

.....

.....

24) The following table represents the percentages of the production of three factories of washing machines:

Factory	First	Second	Third
Percentage	25%	25%	50%

Represent these data by pie charts.

RaNia SaYed

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Pre-exam Final Revision

1 Choose the correct answer:

1) $\mathbb{Z} - \mathbb{N}$ = ... ($\mathbb{Z}^+$ or {0} or $\mathbb{Z}^-$ or 0)

2) An integer included between –2 and 3 is (–2 or –1 or 3 or –3)

3) A number which satisfies the inequality $x > -2$ is (–1 or – 4 or –3 or –2)

4) If $x = -2$, $y = 3$, then $2xy$ = ... (12 or 10 or –12 or 3)

5) $(-2)^3 >$ ($(-2)^3$ or 3^2 or $(-3)^3$ or 3^3)

6) A circle, its diameter length is 8 cm, its area ≃ cm^2. $\left(\pi \simeq \frac{22}{7}\right)$

(52 or 50 or 53 or 48)

7) If $A \subset \{2, -5, -3\} \cap \{5, -2, -3\}$, then A = ... ({2} or {–3} or {–5} or {5})

8) $\mathbb{N} \cup \mathbb{Z}$ = ... ($\mathbb{Z}$ or $\mathbb{N} - \{0\}$ or $\mathbb{Z}-$ or $\mathbb{Z}+$)

9) If $x + 3 = 8$, $x \in \mathbb{Z}^-$, then the solution set = ... ({–3} or {5} or {–5} or ∅)

10) If $2x + 5 > 3$, $x \in \mathbb{Z}$, then the solution set = ... ($\mathbb{N}$ or $\mathbb{N} - \{0\}$ or $\mathbb{Z}^-$ or $\mathbb{Z}^+$)

11) The image of the point A (–4 , 3) by translation (–1 , –4) is

((– 5 , –7) or (–5 , –1) or (–7 , 3) or (–3 , –1))

12) $(-19)^0 + (19)^0$ = ... (–1 or 0 or 1 or 2)

13) $(-1)^{104} + (-1)^{103}$ = ... (0 or –1 or 1 or 2)

14) $|-9| + 3 \div 2$ $\mathbb{Z}$ (∈ or ∉ or ⊂ or ⊄)

15) If a dice is rolled once, then the probability of getting a number > 6 = ...

(∅ or Zero or $\frac{1}{6}$ or $\frac{1}{3}$)

16) The measure of the angle of the sector of a quarter of a circle is

(30° or 45° or 60° or 90°)

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17) $\mathbb{Z}^+ - \mathbb{Z}^- =$ ($\varnothing$ *or* $\mathbb{N}$ *or* $\mathbb{N} - \{0\}$ *or* $\mathbb{Z}$)

18) If $2 \in \{3 , x - 3\}$, then $x =$ (zero *or* –5 *or* 5 *or* 3)

19) If the area of one face of a cube equals 8 cm^2, then its total area = ... cm^2

(12 *or* 30 *or* 42 *or* 48)

20) If the lateral area of the cuboid is 120 cm^2, and the two dimensions of its base are 4 cm and 6 cm, then its height = ... cm (6 *or* 8 *or* 10 *or* 12)

21) Complete the following pattern: –5 , –10 , –15 , –20 , ... (25 *or* –30 *or* –25 *or* –30)

22) $(-1)^8$ $(-1)^{13}$ (> *or* < *or* = *or* ≤)

23) The surface area of the circle whose diameter length is 20 cm = ... cm^2 ($\pi \simeq 3.14$)

(3.14 *or* 31.4 *or* 314 *or* 3140)

24) The equation $3x^2 - x = 21$ is of the degree. (fourth *or* third *or* second *or* first)

25) $(-2)^3 \times (-5)^3 =$ ($(10)^0$ *or* 10 *or* $(10)^2$ *or* $(10)^3$)

26) If A (4 , 9) , B (4 , 5) , then the length of $\overline{AB}$ = ... units. (3 *or* 4 *or* 5 *or* 6)

27) If A is an event in sample space S and P (A) = 0, then A is a/an event.

(impossible *or* sure *or* possible *or* otherwise)

28) The multiplicative neutral element in $\mathbb{Z}$ is (0 *or* 1 *or* –1 *or* –2)

2 Complete the following:

1) The lateral surface area of a cuboid = ...

2) The random experiment is

3) 9 (4 + (–3)) = 9 x + ... x = ...

4) The result of $\frac{(-7)^5 \times 7}{(-7)^3}$ = ...

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5) 2 , 6 , 10 , 14 , ... in the same pattern and its rule is

6) If the total area of a cube is 150 cm^2, then its edge length = ...

7) $|-3| + |3|$ = ...

8) The probability of an impossible event = ...

9) The area of the circle whose circumference is 31.4 cm is cm^2 ($\pi = 3.14$)

10) The image of the point (3 , –2) by translation ($x - 2$, $y + 5$) is

11) If the probability of the appearance of event A is $\frac{2}{3}$, then the probability of non-appearance of event A = ...

12) $3 \times (-5) = (-5) \times 3$ is called property.

13) The sum of measures of the accumulative angles at the centre of the circle is equal to

14) If a = –1 , b = –3, then the value of 3 ab – 7 = ...

15) The solution set of the inequality $x \geq -2$, $x \in \mathbb{Z}$ is

16) The area of a piece of wood in the shape of a circle of radius length 7 cm is cm^2

17) On throwing a fair die once, then the probability of appearing an even prime number = ...

18) The measure of the angle of the circular sector whose area represents $\frac{1}{6}$ of the surface area of the circle = ...

19) $\frac{4^3 \times 4^5}{4^8}$ = ...

20) $-\frac{1}{4}$, $-\frac{1}{8}$, $-\frac{1}{16}$, ..., ... (in the same pattern)

21) The sample space of rolling a die once is

22) If A (–2 , 7) , B (–2 , 7), then the length at $\overline{AB}$ is units.

23) A circle its circumference is 88 cm, then its radius = ... cm. $\left(\pi \simeq \frac{22}{7}\right)$

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24) If $6x = -42$, then $x =$ $(x \in \mathbb{Z})$

25) $- \left| -3 \right| + 4 + (-8) =$

26) The smallest non-negative integer number is

27) $8 \times ((-1) + ...) = 8 \times + ... \times 3$

3 **Solve the following inequality in $\mathbb{Z}$, $-1 < 2x + 3 \leq 5$, and represent the solution on the number line**

4 **Find the S.S. of:**

a) $2x - 3 \geq 5$ in $\mathbb{N}$

b) $5x - 3 = 2x + 3$ in $\mathbb{Z}$

5 Niveen used a piece of a square cardboard of side length 80 cm and she used cut and paste paper tools to design a cuboid with 40 cm length, 20 cm width and 30 cm height.

Show whether the piece of the cardboard is enough to design a cuboid or not.

6 **Determine** the following points A (–3 , 4) , B (1 , 4) and C (1 , 2) on the coordinate plane, then **find**

a) AB = ... , BC = ...

b) The image of Δ ABC by translation (0 , –3).

7 The sum of the edge lengths of a cube equals 108 cm, find its lateral area and its total area, **then find the ratio between them**

8 **Draw** Δ ABC, where A (1 , 1) , B (–3 , –1) , C (0 , –5), **then determine graphically its image by translation (5 , 0).**

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9 If the area of a circle = 2826 cm^2, **find its circumference where** (π = 3.14).

10 The following table shows the percentage of the production of one factory for 4 kinds of the electric sets.

Types of the sets	TV	Washing machine	Refrigerator	Cooker
Amount of the production	30%	25%	15%	30%

Represent these data by using the circular sectors.

11 The following table shows the number of hours that Nahed spends for revising different subjects weekly:

Subjects	Arabic	English	Maths	Science	Social studies	Other subjects
Number of hours	9	6	7	5	6	7

Represent the previous data by using the circular sectors, then answer the following questions.

a) What is the subject which takes the greatest number of hours for weekly revision?

b) What is the subject which takes the least number of hours for weekly revision?

c) What is your advice to Nahed?

12 A box contains 5 white balls and 9 red balls. All balls are symmetrical. If a ball is selected randomly, **write the sample space, then calculate the following probabilities**:

a) Selecting a white ball.

b) Selecting a red ball.

c) Selecting a ball which is neither white nor red.

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13 In an experiment of forming a number which consists of two digits without repeating a digit using the set of numbers {1 , 2 , 3}. **Find:**

a) The probability of getting an odd prime number.

b) The probability of getting an even number.

14 A box contains 10 cards numbered by the even numbers from (2 to 20). If one of the cards is selected randomly, **calculate the probability of**:

a) The event A : the appearance of multiples of number 1.

b) The event B : the appearance of an even number.

c) The event C : the appearance of a number that is divisible by 3.

15 In an experiment of tossing a regular dice once and observing the number of dots on the upper face, **find the probability of**:

a) The event A, where A is the event of the appearance of a number less than 5.

b) The event B, where B is the event of the appearance of a number which satisfies the inequality $B \geq 3$.

16 In one of the "weight loss" centres, 10 ladies suffering from overweight were waiting to enter for meeting the specialised doctor. If the weights of 4 of them are between 100 and 110 kg and the weights of the others are between 110 and 120 kg, **find the following probabilities**:

a) The entrance of a lady whose weight is less than 110 kg.

b) The entrance of a lady whose weight is more than 110 kg.

c) The entrance of a lady whose weight is 90 kg.

17 A box contains some cards numbered from 10 to 19. If one of the cards is selected randomly, **calculate**:

a) The probability of getting a prime number. 11, 13, 17, 19 — $\frac{4}{9}$

b) The probability of getting an even number. $\frac{5}{9}$

c) The probability of getting a number divisible by 5 $\frac{2}{9}$

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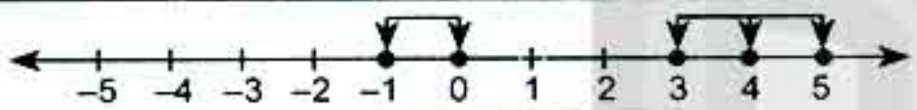
Answer Guide of the Main Book

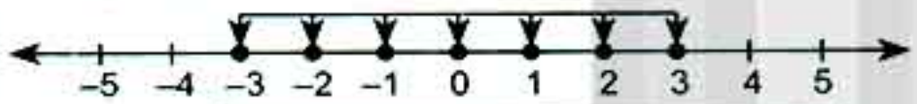
UNIT 1 The integer numbers

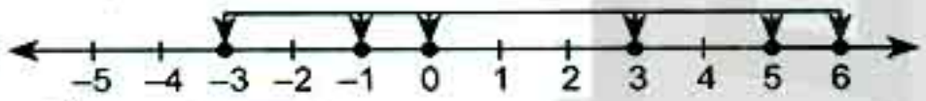
Exercise 1

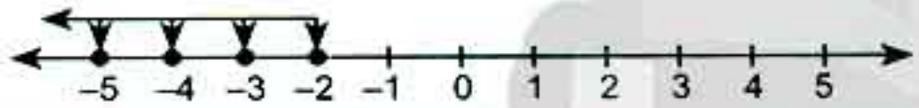
1. a) positive, negative **b)** positive, negative
c) negative **d)** positive **e)** zero

2. a) 2500 **b)** – 1000 **c)** – 20 **d)** 10
e) 30 **f)** 5000 **g)** – 56 **h)** 160
i) –7 **j)** –150

3. a)


b)


c)


d)


4. Left to the student.

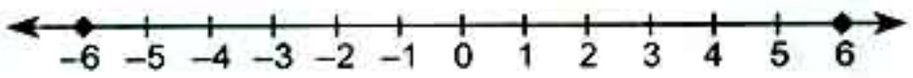
5. a) {–1, 0, 1, 2 ,.....} **b)** {–6 , –7 , –8 , ...}
c) {–3 , –2 , –1 , 0 , 1 , 2}
d) { –5 , –6 , –7.....}
e) {–1 , –2 , –3 , ...}
f) {... , –5 , –3 , –1 , 1 , 3 , 5 , ...}
g) {–2 , –4 , –6 , ...} **h)** {–2 , –1 , 0 , ... , 12}

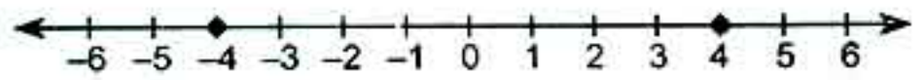
6. a) ∈ **b)** ∉ **c)** ⊂ **d)** ∉ **e)** ⊂
f) ∈ **g)** ∈ **h)** ∉ **i)** ⊂

7. a) $\mathbb{N} - \{0\}$ **b)** $\mathbb{N}$ **c)** ∈ **d)** {–3}
e) ∈ **f)** 12 **g)** 2 **h)** ∅
i) ∉ **j)** ∈ **k)** ∈ **l)** >

8. a) 7 **b)** $\mathbb{Z}^+$ **c)** ∅ **d)** $\{0\} \cup \mathbb{Z}^-$
e) $\mathbb{N}$ **f)** $\mathbb{Z}$ **g)** $\mathbb{N}$
h) $\mathbb{Z}^+ \cup \mathbb{Z}^- = \mathbb{Z}^*$ **i)** {4} **j)** $\mathbb{N}$
k) $\mathbb{Z}^+$ **l)** –1 **m)** 1

9. a) 3 + 5 = 8 **b)** 3 × 2 = 6
c) 7 × 12 = 84 **d)** 45 ÷ 9 = 5
e) 12 + 13 = 25
f) 7 – 7 = zero

10. a)


b)


c) Left to the student.

11.

The number	113	–9	zero	7	8
Its inverse	–113	9	zero	–7	–8

12. a) 4 **b)** – 16 **c)** 100 **d)** –5
e) 0 **f)** 99 **g)** –6 **h)** 3

13. a) 7 or –7 **b)** 16 or –16 **c)** 9

14. a) 3 or –3 **b)** 6 **c)** 9
d) zero **e)** 10 **f)** 4

15. a) $x = -5$ **b)** $x = -9$ **c)** $x = 5$ **d)** $x = -3$
e) $x = 8$ **f)** $x = -2$ **g)** $x = -9$

16. x = any number ∈ $\mathbb{Z}$ except 5 or – 5 or 3

Exercise 2

1. a) > **b)** < **c)** > **d)** =
e) < **f)** < **g)** = **h)** >

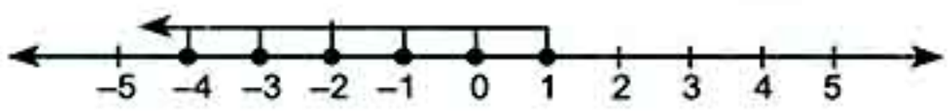
2. a) –1 **b)** > **c)** –6 **d)** –2
e) > **f)** –6 **g)** 5 **h)** 24
i) 3 **j)** 0

3. a) –3, –2, –1, 0, 1 **b)** 0, 1, 2, 3, 4
c) –6, –5, –4, –3, –2, –1 **d)** – 4 , –3
e) –2 , –1 , 0 **f)** 3, 4, 5, 6, 7, 8

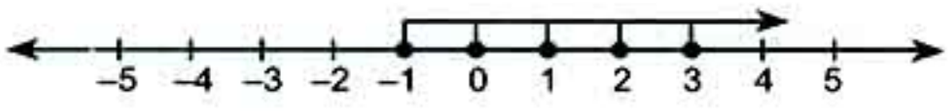
4. a) –10, – 8 **b)** 12, 14 **c)** 22, 24 **d)** –1, 1

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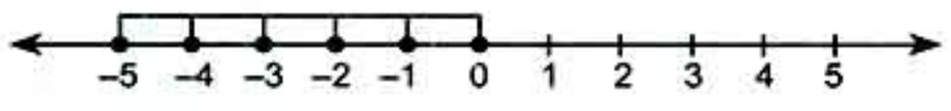
5. a) {1, 0, –1, –2, –3, ...}



b) {–1, 0, 1, 2, ...}



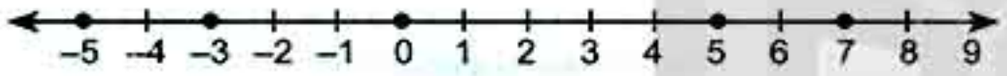
c) {–5, –4, –3, –2, –1, 0}



d) Left to the student.

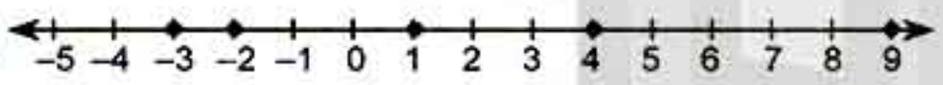
6. Left to the student.

7. a)



Ascending order is: –5, –3, 0, 5, |–7|

b)



Descending order is: 9, |– 4| , 1, –2, –3

8. a) , b) , c) and d) are left to the student.

9. a) , b) , c) and d) are left to the student.

10. a) Ascending order is: –60, –22, –17, 0, 2, 6

b) Ascending order is: –45, –9, 1, 7, 19, 30

c) Ascending order is: –60, –38, zero, |–20|, 27, 50

d) Ascending order is: –17, –11, 0, |–3|, |4|, 5

11. a) Descending order is: 5, 3, 1, –1, –8, –11

b) Descending order is: |70| , 60, –8, –50, –60, –70

c) Descending order is: 15, |–12|, 7, |–3|, –8, –9

d) Descending order is: 17, |–9|, 8, |–7|, zero, –8

12. a) The constant is 1, and the following numbers are –7, –6, –5

b) The constant is 10, and the following numbers are –20, –10, zero

c) The constant is 2, and the following numbers are 6, 8, 10

d) The constant is 1, and the following numbers are –4 , –3 , –2

13. a) –12, –11 **b)** –21, –24 **c)** –16, –18

d) zero, 10 **e)** –10, –5 **f)** 6, 9

14. a) > **b)** > **c)** >

15. The difference between their temperatures

= 3° – (–7)° = 10° c

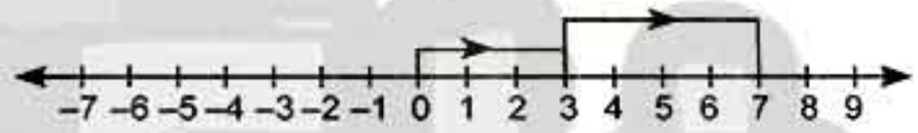
Exercise 3

1. a) (–6) + 8 = 2 **b)** (– 4) + 7 = 3

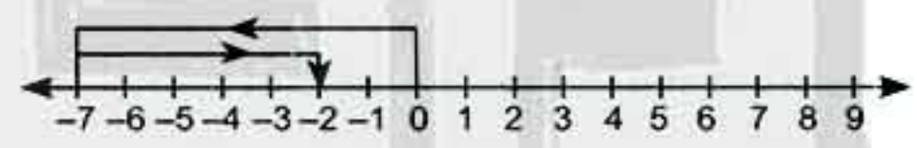
c) 4 + (–9) = –5 **d)** (–2) + (– 4) = –6

e) , f) , g) , h) are left to the student.

2. a)



b)



c), d) , e), f) are left to the student.

3. a) 4 **b)** –10 **c)** –2 **d)** –3

e) –25 **f)** –10 **g)** 15 + 9 = 24

h) –22 + 15 + 27 = 20 **i)** –24 + 17 + (–9) = –16

j) (–11) + (–12) + (–35) = –58

4. a) 3, commutative **b)** –3 , associative

c) zero, neutral element

d) 6 **e)** 1, –1 **f)** –5 **g)** zero

h) b **i)** –5 **j)** 3 **k)** 17

l) 0 **m)** zero **n)** 3

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5. **a)** –5 **b)** –13 **c)** 3 **d)** –7
e) 10 **f)** –6 **g)** –14 **h)** 16
i) 10

6. **a)** 1 **b)** 0 **c)** 3 **d)** 6
e) 2 **f)** 4 **g)** 12 **h)** –4

7. **a)** –1 **b)** – 4 **c)** 5 **d)** –5
e) 55 **f)** ∈ **g)** 8 **h)** 4
i) –3

8. **a)** –15 **b)** –3 **c)** –3 **d)** –11

9. Left to the student.

10. **a)** ✓ **b)** ✓ **c)** ✗ **d)** ✗ **e)** ✓

11. a) (–37) + 19 + (–17)
= [(–17) + (17)] + 19 (commutative, associative)
= 0 + 19 = 19 (additive identity)

b) 115 + (–115) + 198 (commutative)
= [(115) + (–115)] + 198 (associative)
= zero + 198 = 198 (additive identity)

c) Left to the student.

d) (–15) + 15 + 29 (commutative)
= [(–15) + 15] + 29 (additive inverse, associative)
= zero + 29 = (additive identity) = 29

e) [225 + (–25)] + (17 + 83) (commutative)
= 200 + 100 = 300

f) (55 + 45) + (–225 + 225) (commutative)
= (55 + 45) + [(–225) + 225]
(associative, additive inverse)
= 100 + zero = 100 (additive identity)

g) 27 + (–27) + 157 + (–57) (commutative)
= [(27 + (–27) + (157 + (–57)] (associative)
= zero + 100 (additive identity)

h) 26 + (–26) + 20 + 80 (commutative)
= [26 + (-26)] + [20 + 80] (associative)
= zero + 100 = 100 (additive identity)

i) , j) are left to the student.

12. a) ∵ 2 + 7 = 9 ∉ the set.
∴ {2, 7, –2}
is not closed under addition.

+	2	7	–2
2	4	9	0
7	9	14	5
–2	0	5	-4

∵ 2 – 2 = 0 ∉ the set,
∴ {2, 7, –2}
is not closed under subtraction.

–	2	7	–2
2	0	5	–4
7	–5	0	–9
–2	4	9	0

b) – 5 + 3 = –2 ∉ the set,
then {–5, 3, 5}
is not closed under addition.
Also (–5) – 3 = –8 ∉ the set.
Then the set {–5, 3, 5}
is not closed under subtraction.
The rest is left to the student.

13. First:

a) A + B = 2 + (–5) = (–3)

b) B + C = (–5) + (–1) = (–6)

c) A + C = 2 + (–1) = 1

d) A + B + C = 2 + (–5) + (–1)
= 2 + [(–5) + (–1)]
= 2 + (–6) = –4

Second:

a) M + N + (–L) = –2 + (–5) + (–3) = –10

b) M – N – L = (–2) – (–5) –3
= –2 +5 –3 = –2 –3 + 5 (commutative)
= (–2 – 3) + 5 (associative)
= –5 + 5 (additive inverse) = zero

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14. a) $|-5| + 0 = x$ then $5 + 0 = x$ then $x = 5$

b) $-4 + x = -4$ $x = 0$

c) $-3 + (-9) = x$ $x = -12$

d) $x + 5 = 0$ $x = -5$

e) $3 + x = 8$ $x = 8 - 3 = 5$

f) $-2 + x = -10$ $x = -10 - (-2) = -8$

15. The credit $= 6220 - 1211 + 2110$

$= (6220 + 2110) + (-1211)$

$= 8330 + (-1211)$

$=$ L.E. 7119

16. The new depth of the submarine

$= (-90) + 60 = (-30)$

The submarine is at depth of 30 metres from the level of sea.

17. The increasing of temperature degree

$= 11° - (-3)°$

$= 11° + 3° = 14°C$

18. 17 °C.

19. 1st **a)** Zero **b)** –2

2nd **a)** Zero **b)** 12

Exercise 4

1. a) –21 **b)** –24 **c)** zero **d)** –3

e) –20 **f)** –18 **g)** 108 **h)** zero

i) –8 **j)** 4 **k)** – 4 **l)** 112

m) –5 **n)** 3

2. a) 9 **b)** – 4 **c)** –12 **d)** – 4 **e)** 0

3. a) –15 multiplicative identity property

b) 5 associative

c) – 8 commutative

d) zero multiply by zero property

e) 2, 5 distributive property

4. a) $b \times a = a \times b$ (commutative prop.)

b) $(a \times b) \times c = a \times (b \times c)$ (associative prop.)

c) $a \times 1 = 1 \times a = a$ (identity multiplication)

d) a × zero = zero × a = zero (multiplied by zero)

e) $a \times (b + c) = a \times b + a \times c$ (distributive prop.)

5. a) zero **b)** 1 **c)** 4 **d)** –3

e) –24 **f)** – 6 **g)** –1 **h)** 15

i) 3 **j)** zero **k)** –20 **l)** 18

m) 393 **n)** –12 **o)** –6 **p)** – 4

q) 19 **r)** –3

6. a) zero **b)** negative **c)** positive

d) 1 **e)** 1 **f)** zero

7. a) 6 **b)** –3 **c)** 0

d) 1 **e)** –4 **f)** –10

8. a) < **b)** = **c)** > **d)** >

e) > **f)** < **g)** < **h)** <

i) > **j)** = **k)** < **l)** =

9. a) $x = -6$ **b)** $x = -5$ **c)** $x = -8$

d) $x = 4$ **e)** $x = -9$ **f)** $x = -9$

g) $x = -12$ **h)** $x = 10$ **i)** $x = 3$ or -3

j) $x = 6$ or -8 **k)** $x = -4$ **l)** 8

m) 16 or –16 **n)** – 4

10. a) $4 \times (-16) \times 25$

$= 4 \times 25 \times (-16)$ (commutative)

$= 100 \times (-16)$ (multiplication)

$= -1600$

b) $50 \times (-27) \times 2$

$= 50 \times 2 \times (-27)$ (commutative)

$= 100 \times (-27)$ (multiplication)

$= -2700$

c), d) are left to the student.

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11. a) 4 ((–3) +5) (distributive property)

= 4 × 2 = 8 (addition, multiplication)

b) (–6) ((–7) + 2) (distributive property)

= (–6) × (–5) = 30 (multiplication)

c) 69 (143 – 43) (distributive property)

= 69 × 100 = 6900 (multiplication)

d), e) are left to the student.

f) 35 (18 – 34 + 17) (distributive property)

= 35 × 1 = 35 (multiplicative identity)

g) 34 × 102 = 34 × (100 + 2)

= 34 × 100 + 34 × 2

= 3400 + 68 = 3468

h) 24 × 97 = 24 × (100–3)

24 × 100 – 24 × 3

2400 – 72 = 2328

i) 54 × 113 = 54 × (100 + 13)

= 54 × 100 + 54 × 13

5400 + 702 = 6102

j) –14 × 99 = –14 × (100–1)

= –14 × 100 + 14 × 1

= –1400 + 14 = –1386

12. a) (–7) × 17 + (–7) × 3 = –119 + (–21) = –140

or (–7) × 20 = –140

b) 15 × 8 – 15 × 18 = 120 – 270 = – 150

or 15 × –10 = –150

c) 6 × –2 + 6 × –7 = –12 + (–42) = –54

d) 6 × (–6) + 6 × zero = –36 + zero = –36

e) (–5) × 10 + 3 × 10 = –50 + 30 = –20

f) 8 × 6 + (–5) × 6 = 48 + (–30) = 18

g) (–4) + (3) = –1

h) (2) × (–11) = (–22)

in c), d) , e), f), g), h)

the 2nd method is left to the student.

13. First:

a) (a ÷ b) × c = 21 ÷ (–3) × 7 = –7 × 7 = – 49

b) (b × c) ÷ a = (–3 × 7) ÷ 21 = –21 ÷ 21 = –1

c) a ÷ (c × b) = 21 ÷ (7 × (–3)) = 21 ÷ (–21) = –1

d) (2a ÷ 7) ÷ b = (2 × 21 ÷ 7) ÷ (–3) = 6 ÷ (–3) = –2

Second:

a) 3 x – 2 y + Z = 3 × 2 – 2 × 1 + 5

= 6 – 2 + 5 = 9

b) (2x ÷ y) × 3 Z = (2 × 3 ÷ (–1)) × 3 × (–2)

= (6 ÷ (–1)) × (–6)

= (–6) × (–6) = 36

c) x – 2 y ÷ 4 = 8 – (2 × (–2)) ÷ 4 = 8 + 4 ÷ 4 = 9

14. $\therefore \frac{3|x|}{-2} = x - 5$

$\therefore$ 3 $|x| = -2x + 10$

when $x \geq 0$

$\therefore 3x = -2x + 10$

$\therefore 5x = 10 \therefore x = 2$

or when $x < 0$

$\therefore -3x = -2x + 10$

$-x = 10 \therefore x = -10$

Exercise 5

1. a) 2 × 2 × 2 × 2 × 2 = 32

b) 3 × 3 × 3 = 27

c) (–4) × (–4) × (–4) = –64

d) 81 **e)** 1 **f)** –1

g) 1 **h)** 5 × 5 × 5 = 125

i) 7 × 7 = 49 **j)** 8

2. a) –343 **b)** 81 **c)** 1 **d)** –32

e) 16 **f)** zero **g)** 2 **h)** 33

i) ∈ **j)** 1 **k)** 2 **l)** 48

m) zero **n)** 9 **o)** 5 **p)** $x^2 + y$

3. a) x^6 **b)** 25 × 8 = 200

c) – 64 ÷ 16 = –4 **d)** 62 = 36

e) 27 ÷ 27 = 1 **f)** 3 × –32 = –96

g) 49 **h)** 25 × 4 = 100

i) 16 – 27 = – 11 **j)** 1 + (–1) = zero

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4. a) $\frac{3^7}{33} = 3^4 = 81$ **b)** $\frac{2^{15}}{213} = 2^2 = 4$

c) $\frac{(-5)^7}{(-5)^4} = (-5)^3 = -125$ **d)** $\frac{a^{12}}{a^{10}} = a^2$

5. a) $\frac{(3)^{11}}{(8)^3} = 3^3 = 27$ **b)** $\frac{2^{11}}{2^4} = 2^{11-4} = 2^7 = 128$

c) $\frac{2^{10}}{2^9} = 21 = 2$ **d)** $(-3)^{3+4-5} = (-3)^2 = 9$

e) $\frac{-8^3 \times 8^4}{-8^7} = 8^{3+4-7} = 8^{zero} = 1$

f) $9^{6+3-5-2} = 9^2 = 81$

g) $-\frac{(3)^6}{3^3} + \frac{4^5}{4^3} = -3^3 + 4^2 = -27 + 16 = -11$

h) $\frac{(-8)^5}{(8)^3} \times (-7)^{zero} = -8^2 \times 1 = -64 \times 1 = -64$

i) $\frac{-(9)^5}{9^4} \times 9^2 = -9 \times 9^2 = -9^3 = -729$

6. a) > **b)** > **c)** = **d)** >

e) = **f)** < **g)** = **h)** =

i) < **j)** =

7. a) $(-1)^3, (25)^{zero}, 3^2$

b) $(-2)^5, (-3)^3, (-1)^{15}, (-4)^0, (-3)^2$

c) $(-5)^2, (-3)^2, (-1)^7, (-2)^3$

d) $100000, 100^2, 10^2, (-1)^5, (-10)^3$

8. a) $18\ (18 + 12) = 18 \times 30 = 540$

b) $112\ (17 + (-17)) = 112 \times zero = zero$

c) $24\ (24 + 77 - 1) = 24 \times 100 = 2400$

9. a) $a^2 + b^2 = (-2)^2 + (-1)^2 = 4 + 1 = 5$

b) $(a + b)^3 = ((-2) + (-1))^3 = (-3)^3 = -27$

10. a) $x^{9-4-5} = x^{Zero} = 1$

b) $x^{1+2+8-3-7} = x^1 = x$

c) $x^{5-4} \times y^{4-4} = x \times y^0 = x$

d) $a^{13-8-3} = a^2$

11. a) $15 \times (15 + 25) = 600$

b) $24 \times (44 - 24) = 480$

c) $18 \times (18 + 83 - 1) = 1800$

d) Left to the student.

12. Left to the student.

Exercise 6

1. a) 9, 11, 13, 15, 17 **b)** 13, 16, 19, 22, 25

c) 6, 8 , 10, 12, 14 **d)** 0, –4, –8, – 12, – 16

e) –14, –12, –10, –8 , –6

f) –5, –9, –13, –17, –21

g) 9, 3, 1, $\frac{1}{3}$, $\frac{1}{9}$ **h)** $\frac{1}{24}$, $\frac{1}{48}$

2. a) 34, 30, 26 **b)** –6, –3, zero

c) 243, 729, 2187 **d)** 46, 54, 62

e) $\frac{1}{32}$, $\frac{1}{64}$, $\frac{1}{128}$ **f)** 21, 34, 55

g) 36, 49, 64 **h)** 125, 216, 343

i) 8, 12, 16

3. a) $\frac{1}{2}$, $\frac{1}{4}$, zero **b)** 30 , 36 , 42

c) 20 , 24 , 28 **d)** 13 , 15 , 17

e) 21 , 28 , 36 **f)** –20 , –15 , –10

4. a) 1.5, 3, 3.5 **b)** 32, 4, 2

c) 11, 27, 31 **d)** 18, 6, 3

e) 47, 41, 17 **f)** 10, 19, 22

5. a) Each number is less than its preceding by 5.

b) 24 , 20

c) The next number is ten times its preceding.

d) 32 , 64.

e) Each number is more than its preceding by 4.

f) 9, 14, 19, 24

g) Each number is more than its preceding by $\frac{1}{4}$.

h) Each number is three times its preceding.

i) 31, 28, 25, 22

From 6 to 9. are left to the student.

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10. The pattern is: 6, 12, 18, 24, 30, 36, 42, 48, 54

The number of the days is 9 days.

The rule is: Each number is more than its predecessor by 6

11. 85 , 80 , 75 , 70 , 65 , 60 , 55

The number of the months is 6 months.

The rule is: Each number is less than its predecessor by 5

Answers of selected problems from previous exams on Unit 1

1. **1)** $\in$ **2)** 3^2 **3)** Zero **4)** $\mathbb{Z}^-$

5) $\subset$ **6)** $x^2 + y$ **7)** –25 **8)** $\in$

9) –1 **10)**8 **11)** 100 **12)** $\in$

13) –2 **14)** 1 **15)** Zero **16)** 9

17) –1 **18)** 6^2

2. **1)** {3} **2)** distributive **3)** 2

4) –4 **5)** $\{0\} \cup \mathbb{Z}^+$ (or $\mathbb{N}$) **6)** –8

7) –9 **8)** 16 **9)** –15, –9, |–9|, 16, 17

10) 21 **11)** commutative **12)** –12

13) Zero **14)** 3^3 **15)** $\frac{5}{3}$, 2 **16)** $\frac{3}{2}$, $\frac{7}{4}$

17) 19 , 23 **18)** 16, 19 **19)** 2 **20)** –5, –9

21) 5, 2 , –9, –12

3. **1)** $\frac{(3)^2 \times (3)^5}{(-3)^6} = \frac{(3)^{2+5}}{(3)^6} = (3)^{7-6} = (3)^1 = 3$

2) $\frac{(-3)^4 \times (-3)^5}{(-3)^6 \times (-3)} = (-3)^{4+5-6-1} = (-3)^2 = 9$

3) $\frac{2^4 \times 2^3}{2^5} = 2^{4+3-5} = 2^2 = 4$

4) $\frac{(-2)^5 \times (-2)^2}{(-2)^4} = (-2)^{5+2-4} = (-2)^3 = -8$

5) $\frac{7^4 \times 7^5}{7} = 7^{4+5-7} = 7^2 = 49$

6) Left to the student.

7) = 190 + 116 + (–116) (commutative property)

= 190 + [116 + (–116)] (associative property)

19 + Zero = 190 (additive identity)

8) 6

9) $(3)^3 + (-2)^1 = 27 - 2 = 25$

Test on UNIT 1 from the School Book

1. a) $\mathbb{Z}$ **b)** $\mathbb{Z}^-$, {0} **c)** 1 **d)** $\mathbb{N}$

e) $\varnothing$ **f)** –54 **g)** $\notin$ **h)** $\notin$

2. 7, 0, –9, –15

3. Left to the student.

4. a) –5 + 8 – 15 = –5 –15 + 8 (commutative)

= (–5 –15) + 8 (associative)

= –20 + 8 (addition)

= –12

b) –1 + 4 + 41 = –1 + (4 + 41) (associative)

= –1 + 45 = 44 (addition)

5. The difference between Cairo and Moscow in temperature = 18° – (– 4°) = 22°

The traveller should wear heavy clothes.

6. a) 9 **b)** 8 × 1 ÷ 8 = 1

c) $-4^4 = -256$

7. 7 months

The numerical pattern is:

90, 87, 84, 81, 78, 75, 72, 69

Description: Each weight is less than its predecessor by 3 kg.

8. – The numbers of dots are: 1, 3, 6, 10, 15

– The numerical pattern is: 1, 3, 6, 10, 15, 21 , ...

– The rule of pattern is: Each number is more than its predecessor by 2, then 3, then 4, then 5, then 6 and so on.

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UNIT 2 The equations and the inequalities

Exercise 1

1. a) first b) {0} c) equal d) second
e) ∅

2. a) 12 b) – 4 c) 0 d) third
e) second f) 3 g) 5
h) $2x + 3 = 7$

3. a) first b) second c) second d) second
e) third f) fourth g) third h) first
i) second j) first k) second l) third

4. a) {4} b) {7} c) {8} d) {0}
e) {5} f) {3} g) {5} h) {5}
i) ∅ j) {3}

5. a) {0,1} b) {6, 7}
c) {2, 3} d) {–1, 0, 1, 2}
e) {–1, 0, 1, 2} f) {0, 1, 2}
g) {–2, 0, 2, 3} h) {0, 1}
i) {–3, –4, –5, –6} j) {–1, 0, 1}

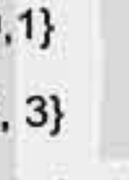
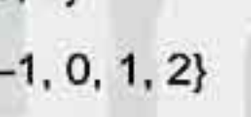
6. Left to the student.

7. a) {6} b) {3} c) ∅ d) {9}

8. a) {3} b) {0, 1} c) {7} d) ∅

9. Left to the student.

10. a) {–2,2} b) {– 4,4}
c) {–1, 0,1,2} d) {–1, –2, 1}

11. a)  = 6 b)  = 12

Exercise 2

1. a) 10 b) {3} c) {4} d) {3}
e) –4 f) {–3} g) 2 h) 15

2. a) 4 b) 20 c)3 d) {4}
e) 7 f) –3 g) 1

From h) to j) are left to the student.

3. a) {6} b) {9} c) {11} d) {5}
e) {3} f) {4} g) {3} h) {3}

4. a) {–2} b) {52} c) {40} d) {5}
e) {–8} f) ∅ g) {8} h) {–5}
i) {1} j) {– 4}

5. a) ∅ in N, Z b) ∅ in N, {–2} in Z
c) ∅ in N, Z d) ∅ in N and {–8} in Z
e) {13} in N, and Z f) ∅ in N, and {– 4} in Z

6. a) {6} b) {3} c) {–1} d) {–8}
e) ∅ in N , {–16} in Z f) {–10} g) {6}

7. a) $x = -4$ b) $x = 3$ c) $x = 5$ d) $x = -21$

8. Since $x + 2x = 18$, then $3x = 18$,
then $x = 6$ Then the number is 6

9. Since $x + 3x = 72$, then $4x = 72$, then $x = 18$
Then the number is 18

10. Since $x + x + 1 = 21$, then $2x = 20$, then $x = 10$
Then the two consecutive numbers are 10 , 11

11. Left to the student.

12. $4x + 3x + 2x = 180^\circ \therefore 9x = 180^\circ, \therefore x = 20^\circ$

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13. Let the width be x, then its length is $3x$

Its perimeter = $(x + 3x) \times 2$

The equation is $(x + 3x) \times 2 = 48$

$4x = 24$

$x = 6$ cm

Then width = 6 cm

and length = 18 cm

its area = $6 \times 18 = 108$ cm^2

14. a) 5, 15, 25

b) $x - 1 = 2$ or $x - 1 = -2$

Then $x = 3$ or $x = -1$

Exercise 3

1. First:

a) $x < -5$ **b)** $x \geq 3$ **c)** $x \leq 2$

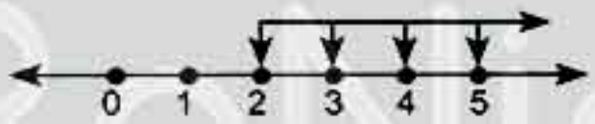
d) $2 < x < 5$ **e)** $1 < x \leq 7$ **f)** $-4 \leq x \leq 1$

Second:

a) $x > -3$ **b)** 4 , 2 **c)** 9 , –3

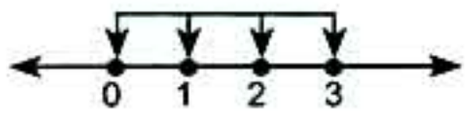
2. a) $x + 4 > 5$ $x > 5 - 4$

$x > 1$ S.S. = {2, 3, 4, ...}



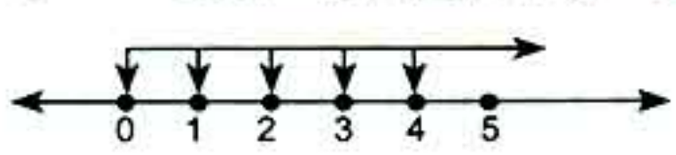
b) $x - 3 < 1$ $x < 1 + 3$

$x < 4$ S.S. = {3, 2, 1, 0}



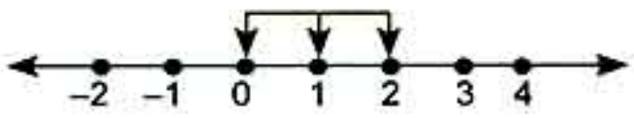
c) $x + 7 > 4$ $x > 4 - 7$

$x > -3$ S.S. = {0, 1, 2, 3} = N



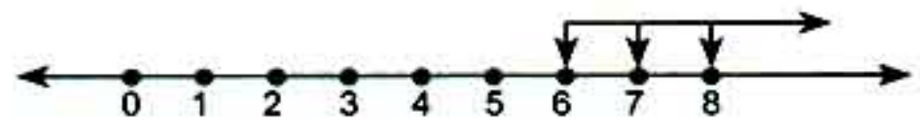
d) $x + 4 < 7$ $x < 7 - 4$ $x < 3$

then S.S. = {0, 1 , 2}



e) $5x \geq 30$ (÷5)

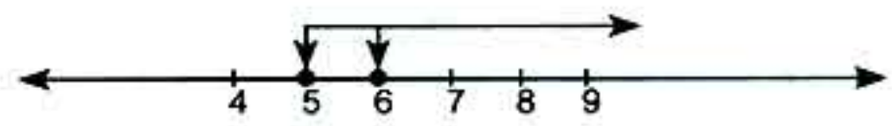
$x \geq 6$ S.S. = {6, 7, 8, ...}



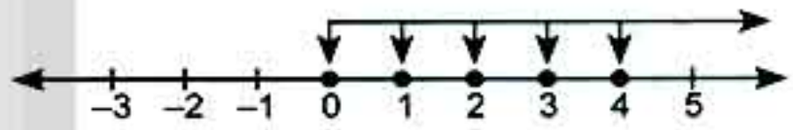
f) $-2x \geq 6$ (÷ – 2)

$x \leq -3$ S.S. = ∅

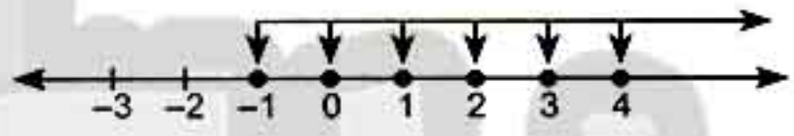
3. a) In N and in Z = {5, 6, 7,.....}



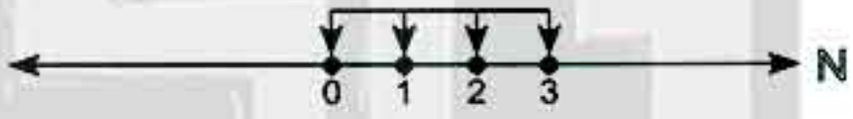
b) In N S.S. = {0, 1, 2, 3, ...}



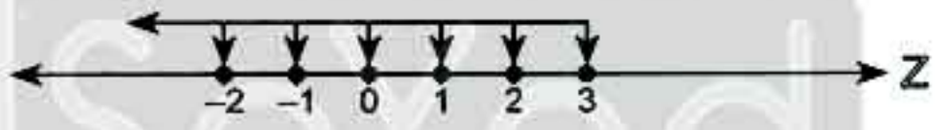
In Z S.S. = {–1, 0, 1, 2, 3, ...}



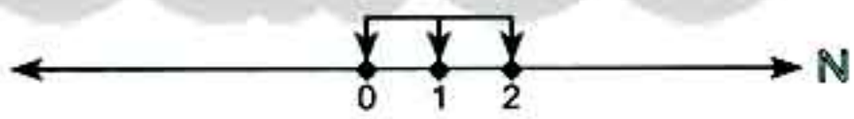
c) In N {0, 1, 2, 3}



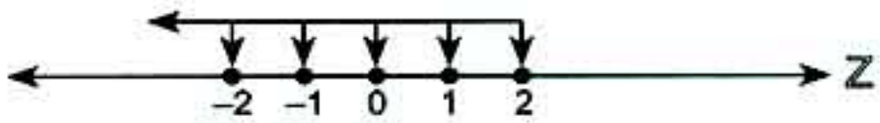
In Z {3, 2, 1, 0, –1, ...}



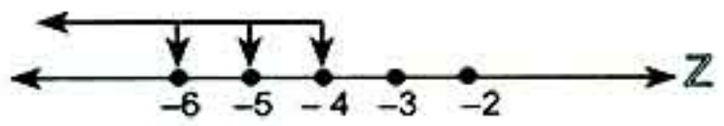
d) In N {2, 1, 0}



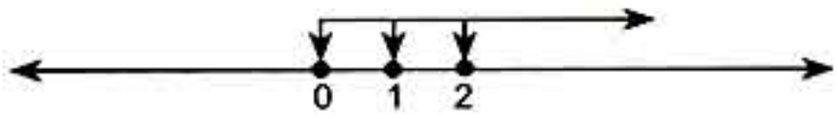
In Z {2, 1, 0, –1, –2, ...}



e) ∅ In N and in Z {– 4, –5, –6, ...}



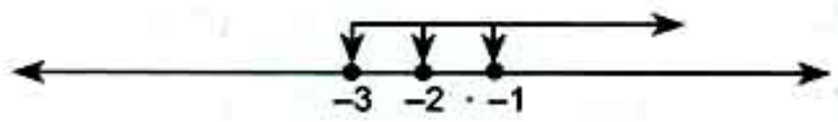
f) In N {0, 1, 2, ...}



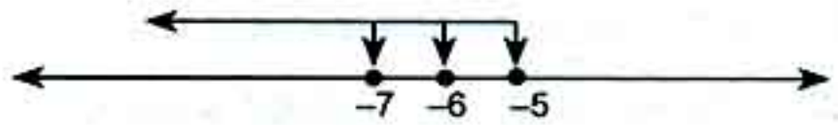
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In Z {–3, –2, –1, ...}



g) In N ∅ and in Z {–5, –6, –7, ...}

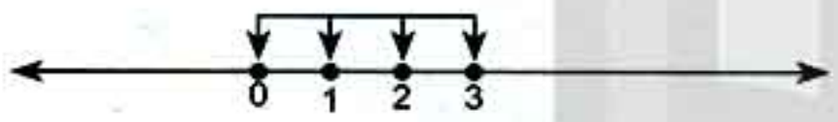


h) Left to the student.

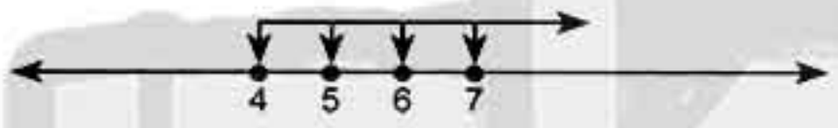
4. a) {0, 1}



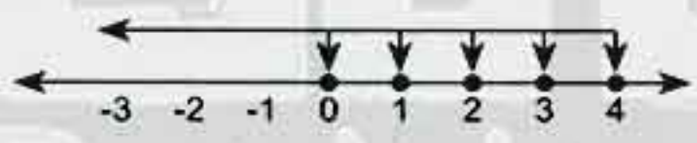
b) {0, 1, 2, 3}



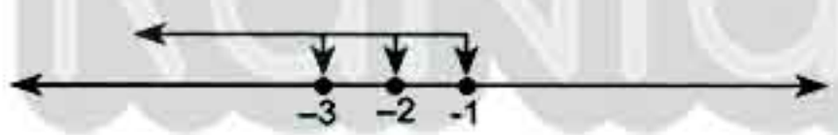
c) {4,5,6,....}



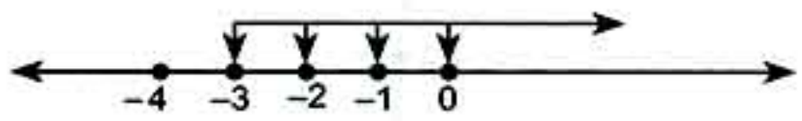
d) {4, 3, 2, 1, ...}



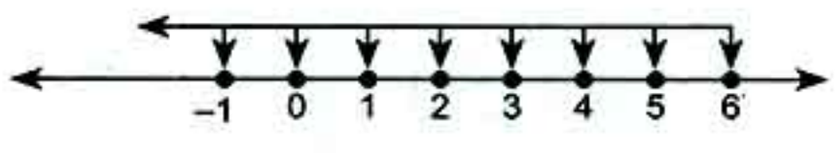
e) {–1, –2, –3}



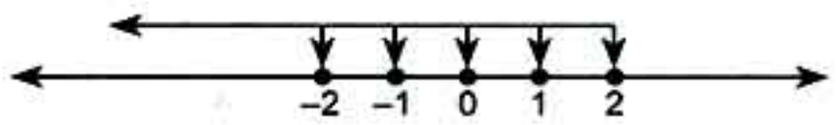
f) {–3, –2, –1, 0, ...}



g) {6, 5, 4, 3,....}



h) {2, 1, 0, –1, –2,....}



5. a) {0, 1, 2} b) {2, 1, 0, ...}

c) {1, 2}

6. a) 8 b) –3 c) Z^+ d) N

e) > f) < g) > h) – 4

i) 0 j) ∅ k) {–1, 0, 1}

l) 5 m) $-x < 4$ n) {1 , 2}

7. a) {0, 1, 2, 3} b) {–2, –1, zero, 1, ...}

c) {1, 2, ...} d) {zero} e) ∅

f) ∅ g) {3, 4, 5, ...}

h) {1, 2, 3, ...}

8. Left to the student.

9. a) 8 b) > c) > d) < e) >

10. Left to the student.

Answers of selected problems from previous exams on Unit 2

1. 1) 3 2) {0 , 1} 3) Second 4) –3

5) 5 or –5 6) 5

2. 1) –2 2) $\frac{x}{3}$ 3) Z^+ 4) $x < 3$

5) ∅

3. 1) Left to the student.

2) $2x + 12 = 8$ $2x = 8 - 12$ $2x = -4$

$x = -2$ S.S. = {–2}

3) $2x + 5 = 9$ $2x = 9 - 5$ $2x = 4$

$x = 2$ S.S. = {2}

Test on UNIT 2 from the School Book

1. a) That contains an equal relation between two mathematical sentences.

b) That contains an inequality relation between two mathematical sentences.

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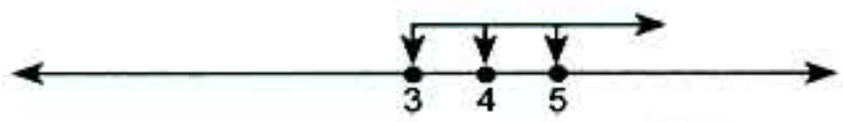
c) It is the set of numbers which may contain the values of the unknown in the equation (or inequality)

d) a subset from the substitution set which verifies the equation or inequality.

2. a) –2 **b)** –1 **c)** 6 **d)** –1

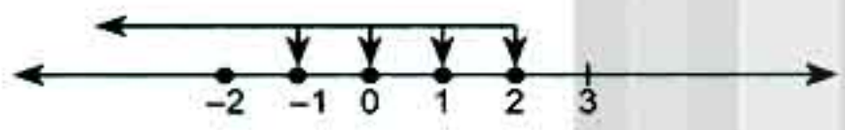
3. a) $3x + 2 \geq 11$ $3x \geq 9$

$x \geq 3$ S.S. = {3, 4, 5, ...}



b) $4x < 13 - 1$ $4x < 12$

$x < 3$ S.S. = {2, 1, 0, –1, ...}



4.a) ∅ **b)** {–5} **c)** {3} **d)** {–10}

UNIT 3 Geometry and measurement

Exercise 1

1. Length of $\overline{AB}$ = |5 – (–2)| = |5 + 2| = |7|
= 7 length units

2. Length of $\overline{DE}$ = |–5 – (–2)|
= |(–5 + 2)| = |–3| = 3 length units

3. a) AB = |– 4 –5| = |–9| = 9 length units

b) DC = |3 – (–2)| = |5| = 5 length units

c) CB = |– 4 –3| = |–7| = 7 length units

d) FD = |–2 – 0| = |–2| = 2 length units

4. b) AC = |–2 –6| = |–8| = 8 length units

c) DA = |6 –(–5)| = |11| = 11 length units

d) DB = |3 –(–5)| = |8| = 8 length units

e) DF = |0 –(–5)| = |5| = 5 length units

f) DC – BA = |–2 – (–5)| – |6 –3| = |3| –|3|
= 3 –3 = zero

g) DC + FB = |–2 – (–5)| + |3 – 0| = |3| + |3|
= 3 + 3 = 6 length units

5. a) AD = |4– (–5)| = |9| = 9 length units

b) AF = |0 – (–5)| = |5| = 5 length units

c) FD = |4 – 0| = |4| = 4 length units

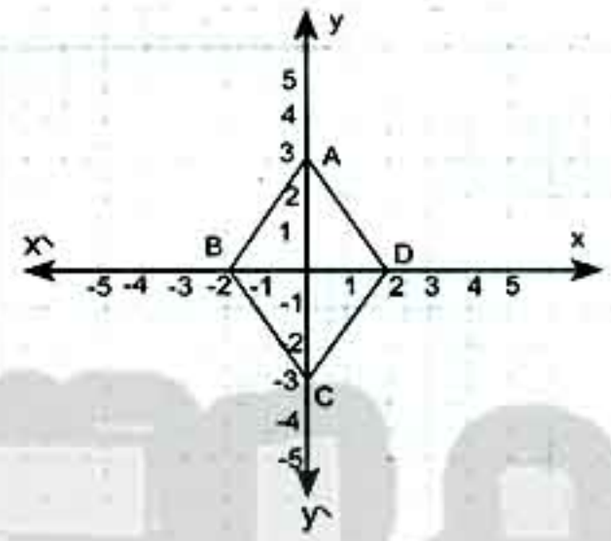
d) FD + BF = |4 – 0| + |0 –(–3)| = |4| + |3|
= 4 + 3 = 7 length units

e) CD = |D – C| = |4 –1| = 3 length units
BF = |0 – (–3)| = |3| = 3 length units CD = BF

f) CF = |0 – 1| = |–1| = 1 length unit

g) AB + CD = |–3 + 5| + |4 –1| = |2| + |3|
= 2 + 3 = 5 length units

6. a)



b) Length of $\overline{AC}$ = |–3 –3| = |–6| = 6 length units

c) Length of $\overline{BD}$ = |2 – (–2)| = |4| = 4 length units

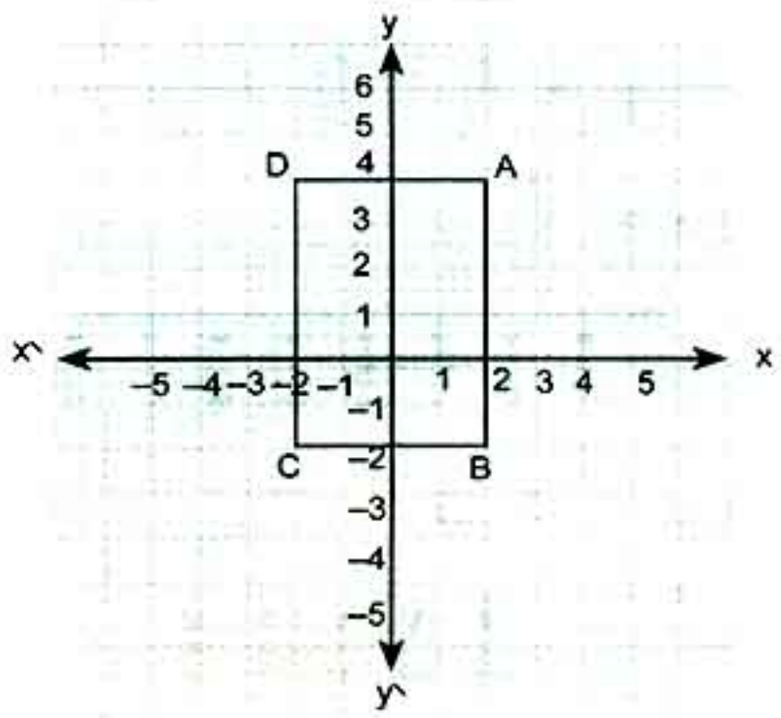
d) The shape is a rhombus.

e) The area of the shape = $\frac{1}{2} \times AC \times BD$
= $\frac{1}{2} \times 4 \times 6 = 12$ square units

f) $\overleftrightarrow{AC}$, $\overleftrightarrow{BD}$

7. Left to the student.

8. a)



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b) AB = |–2 –4| = |–6| = 6 length units

BC = |–2 –2| = |–4| = 4 length units

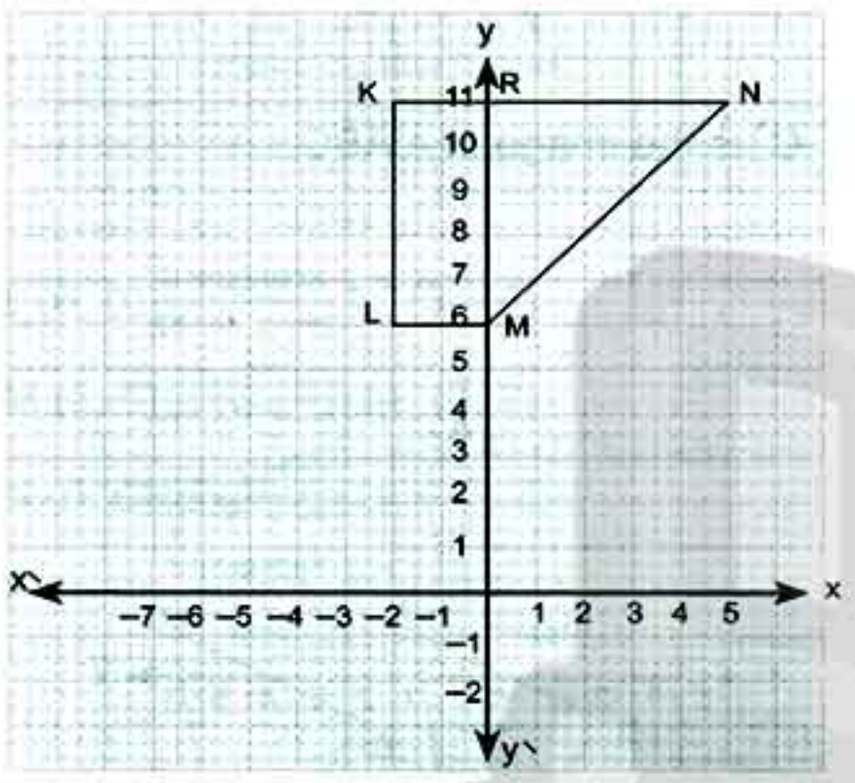
CD = |4 –(–2)| = |6| =6 length units

DA = |–2 –2| = |–4| =4 length units

c) A rectangle.

d) Area = length × width = 6 × 4 = 24 square units

9.



a) Length of $\overline{ML}$ = |(–2) –0| = |–2| = 2 l length units

Length of $\overline{NK}$ = |–2–5| = |– 7| = 7 length units

b) The shape is a trapezium.

c) The area of trapezium

= area of rectangle LMRK + area of Δ MRN

= LM × LK + $\frac{1}{2}$ NR × MR = 2 × 5 + $\frac{1}{2}$ × 5 × 5

= 10 + $\frac{25}{2}$ = 22 $\frac{1}{2}$ square units

10. a) Length of $\overline{AB}$ = |4 –(–2)| = |6|

= 6 length units

b) Length of $\overline{AB}$ = |8 –3| = |5|

= 5 length units

c) Length of $\overline{AB}$ = |–4 –(–6)| = |2|

= 2 length units

d) Length of $\overline{AB}$ = |–5 –13| = |–18|

= 18 length units

11. a) O (0 , 0) , A (3 , 0) , B (3 , 3) , C (0 , 3)

b) The area = 3 × 3 = 9 square units

c) The perimeter = 4 × 3 = 12 length units

12. a) A (3, 5), B (0, 1) C (–3, 5), D (0, 9)

b) AC = |–3 –3| = |–6| = 6 length units

BD = |9 –1| = |8| = 8 length units

The area of a rhombus = $\frac{1}{2}$ × AC × BD

= $\frac{1}{2}$ × 6 × 8

= 24 square units

13. 1) AB = 7 units AC = 6 units.

2) Right-angled Δ , Scalene Δ

3) Area = $\frac{1}{2}$ × 6 × 7 = 21 square units.

The drawing is left to the student.

14. BC = 6 units K = 2

Exercise 2

1. a) symmetric **b)** not symmetric

c) symmetric **d)** symmetric

e) not symmetric **f)** symmetric

g) symmetric **h)** symmetric

i) not symmetric

The drawing is left to the student.

2. a) reflection **b)** translation

c) rotation **d)** reflection

e) translation **f)** translation

g) reflection **h)** translation

i) rotation

3. Left to the student.

4. a) (6 , 3) **b)** (–5 , 4)

c) (x – 1 , y – 3) **d)** (–1 , 0)

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5. a) 1 **b)** 4 **c)** 3 **d)** (–2, 0)
e) (–1, –1) **f)** (2, 2) **g)** (–3, 0) **h)** (5, 4)
i) (5, –6) **j)** (–2, –7) **k)** (0, 3) **l)** (4, 0)

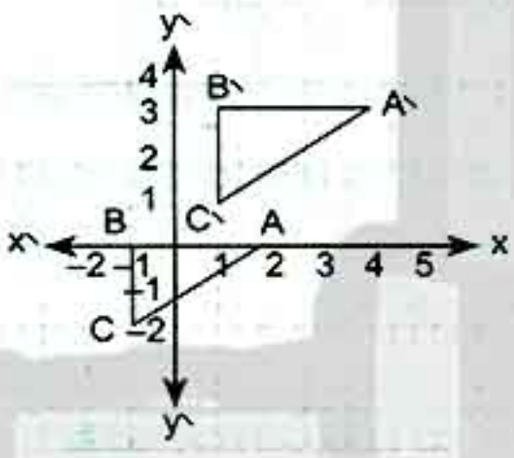
6. a) (2, 4) **b)** (5, 4) **c)** (2, 1) **d)** (2, 6)
e) (1, 4) **f)** (–3, 1) **g)** (7, –4)
From h) to j) are left to the student.

7. (a, b) = (–4 – 3, 5 – (–2) = (–7, 7)

8. The point A = (2 –1, 0 – (–5)) = (1, 5)

9. a) A (2, 0), B (–1, 0), C (–1, –2)

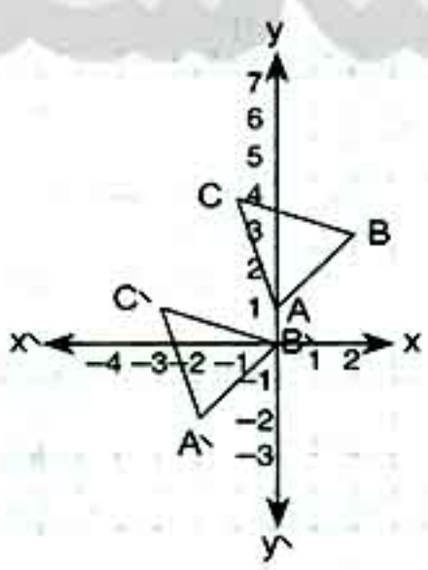
b) A` (4,3), B` (1,3), C` (1,1)



c) Length of $\overline{BC}$ = |–2 – 0| = |–2| = 2 length units
Length of $\overline{AB}$ = |–1 – 2| = |–3| = 3 length units

d) Not symmetric, because we cannot draw any line to divide it into two congruent figures.

10.

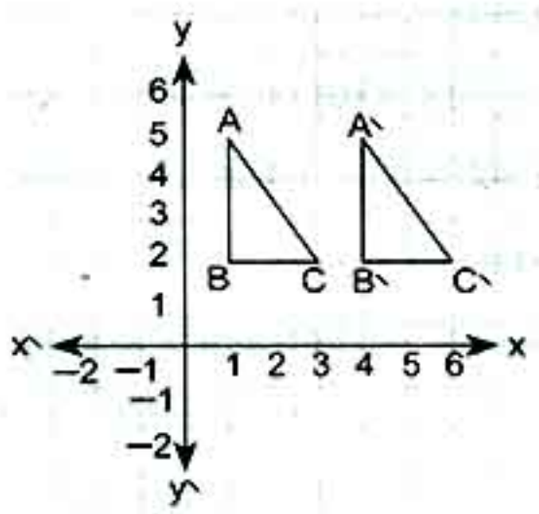


A (0, 1) $\xrightarrow[(-2,-3)]{\text{translation}}$ A` (–2, –2)

B (2, 3) $\xrightarrow[(-2,-3)]{\text{translation}}$ B` (0, 0)

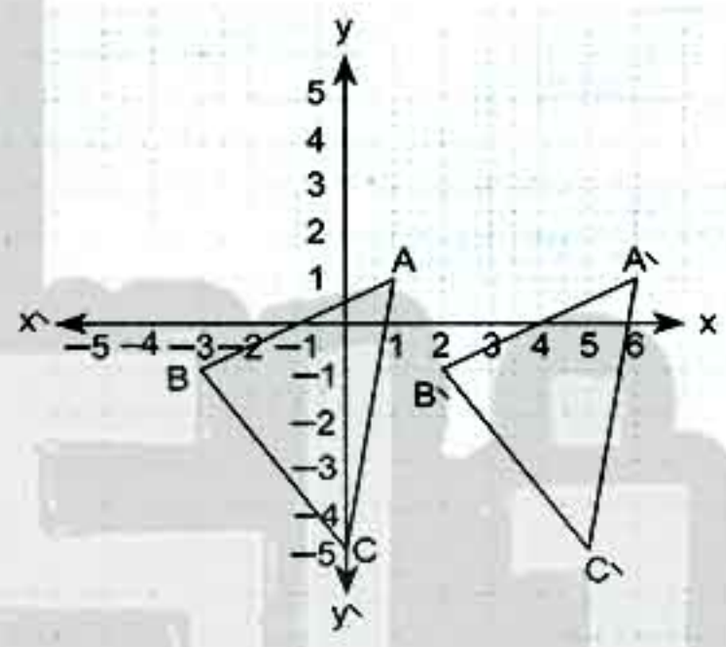
C (–1, 4) $\xrightarrow[(-2,-3)]{\text{translation}}$ C` (–3, 1)

11.



Δ A` B` C` is the image of Δ ABC.

12.

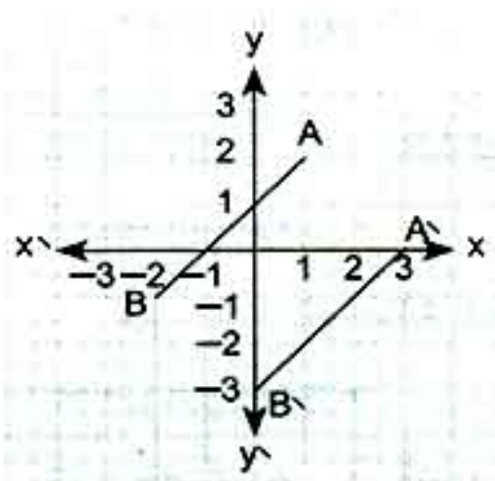


A (1, 1) $\xrightarrow[(5,0)]{\text{translation}}$ A` (6, 1)

B (–3, –1) $\xrightarrow[(5,0)]{\text{translation}}$ B` (2, –1)

C (0, –5) $\xrightarrow[(5,0)]{\text{translation}}$ C` (5, –5)

13.

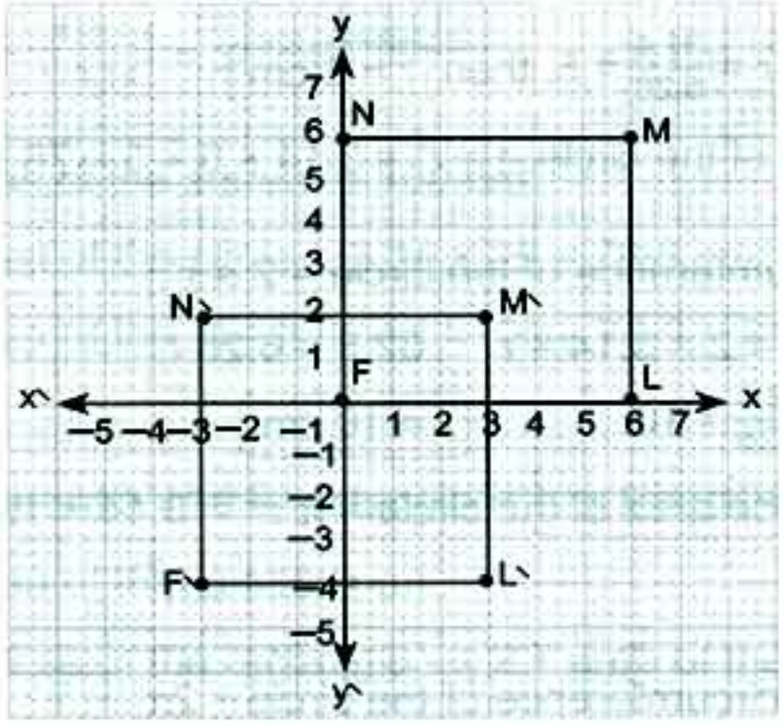


A (1, 2) $\xrightarrow[(2,-2)]{\text{translation}}$ A` (3, 0)

B (–2, –1) $\xrightarrow[(2,-2)]{\text{translation}}$ B` (0, –3)

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14.



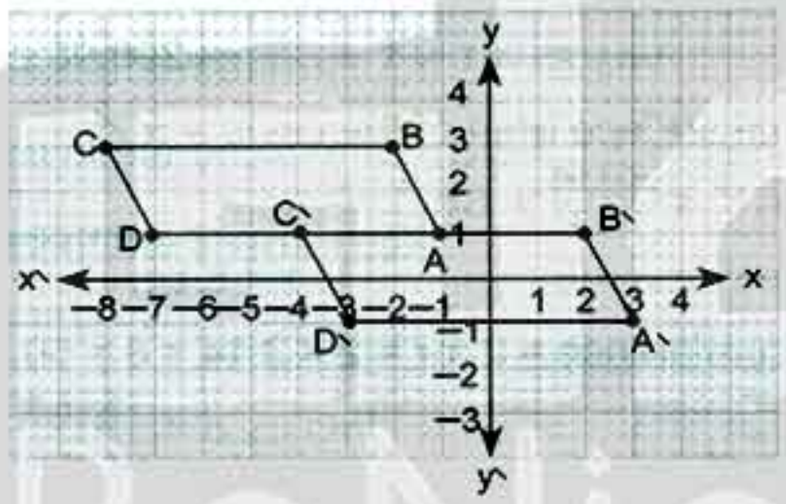
L (6, 0) $\xrightarrow[(x-3,\ y-4)]{\text{translation}}$ L` (3, –4)

M (6, 6) $\xrightarrow[(x-3,\ y-4)]{\text{translation}}$ M` (3, 2)

N (0, 6) $\xrightarrow[(x-3,\ y-4)]{\text{translation}}$ N` (–3, 2)

F (0, 0) $\xrightarrow[(x-3,\ y-4)]{\text{translation}}$ F` (–3, –4)

15.



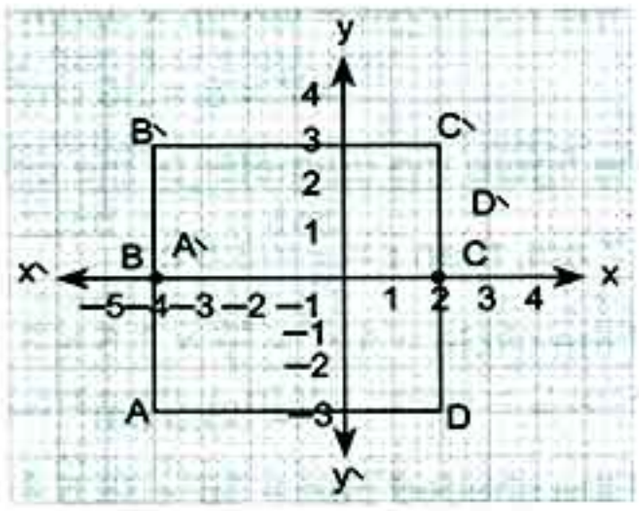
A (–1, 1) $\xrightarrow[(x+4,\ y-2)]{\text{translation}}$ A` (3, –1)

B (–2, 3) $\xrightarrow[(x+4,\ y-2)]{\text{translation}}$ B` (2, 1)

C (–8, 3) $\xrightarrow[(x+4,\ y-2)]{\text{translation}}$ C` (–4, 1)

D (–7, 1) $\xrightarrow[(x+4,\ y-2)]{\text{translation}}$ D` (–3, –1)

16.



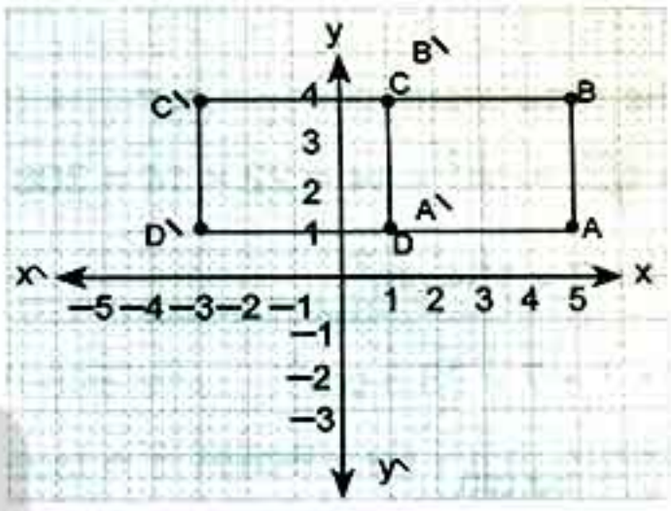
A (–4, –3) $\xrightarrow[(x,\ y+3)]{\text{translation}}$ B (–4, 0)

B (–4, 0) $\xrightarrow[(x,\ y+3)]{\text{translation}}$ B` (–4, 3)

C (2, 0) $\xrightarrow[(x,\ y+3)]{\text{translation}}$ C` (2, 3)

D (2, –3) $\xrightarrow[(x,\ y+3)]{\text{translation}}$ C (2, 0)

17.



a) Length of $\overline{AB}$ = |4 – 1| = | 3 | = 3 length units

Length of $\overline{CD}$ = |1– 4| = |–3| = 3 length units

Length of $\overline{AD}$ = |1 – 5| = |–4| = 4 length units

Length of $\overline{BC}$ = |1 – 5| = |–4| = 4 length units

b) The perimeter of the shape

= (length + width) × 2

= (4 + 3) × 2 = 7 × 2 = 14 length units

c) The area of the shape = length × width

= 4 × 3 = 12 square units

d) Translation (AD) = image – point

= coordinate of point D – coordinate of point A

= (–4, 0).

A (5, 1) $\xrightarrow[(-4,\ 0)]{\text{translation}}$ D (1, 1)

B (5, 4) $\xrightarrow[(-4,\ 0)]{\text{translation}}$ C (1, 4)

C (1, 4) $\xrightarrow[(-4,\ 0)]{\text{translation}}$ C` (–3, 4)

D (1, 1) $\xrightarrow[(-4,\ 0)]{\text{translation}}$ D` (–3, 1)

The image of ABCD is DCC`D`

18. D` (5, 2), E` (2 , 3), shape DD`E`E.

The drawing is left to the student.

It is a parallelogram because

$\overline{D`E`}$ // $\overline{DE}$, $\overline{EE`}$ // $\overline{DD`}$

From 19 to 26 are left to the student.

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Exercise 3

1. a) $\pi\ r^2$

b) Area $= 49\ \pi\ cm^2$

c) $r^2 = 616 \div \frac{22}{7} = 616 \times \frac{22}{7}$

$= 196\ cm^2 = 14 \times 14$, $r = 14\ cm$

d) $\frac{1}{2}$ of the circumference $= \frac{1}{2} \times \pi\ r^2$

$= \frac{1}{2} \times \frac{22}{7} \times 14^2 \times 14 = 22 \times 14 = 308\ cm^2$

e) $\frac{22}{7} \times 7 \times 7 = 154\ cm^2$

f) $\frac{1}{4} \times \frac{22}{7} \times 7 \times 7 = 38.5\ cm^2$

g) $r = \frac{\pi\ 20}{2\ \pi} = 10\ cm$

Area of the circle $= 100\ \pi\ cm^2$

h) $\pi\ cm^2$

2. a) $\pi\ r^2$ **b)** $\frac{1}{2}\pi\ r^2$ **c)** 16

d) r **e)** $2\ \pi\ r$

3. Area of the circle $= \pi\ r^2 = \frac{22}{7} \times 6 \times 6 \simeq 113\ cm^2$

4. Area of the sector $= \frac{1}{5}\pi\ r^2$

$= \frac{1}{5} \times 3.14 \times 4 \times 4 \simeq 10.048\ cm^2$

5. Area of the circle $= \pi r2$

r^2 = area of the circle $\div \pi = 314 \div 3.14$

$r^2 = 100 = 10 \times 10$

$r = 10\ cm$

Circumference $= 2\ \pi\ r = 2 \times 3.14 \times 10$

$= 62.8\ cm \simeq 63\ `cm$

6. r^2 = area of the circle $\div \pi = 154 \div \frac{22}{7}$

$r^2 = 154 \times \frac{22}{7}$ $r^2 = 49$

$r^2 = 7 \times 7$ then $r = 7\ cm$

Circumference $= 2\ \pi\ r = 2 \times \frac{22}{7} \times 7 = 44\ cm$

7. $r = \frac{\text{circumference}}{2 \times \pi} = \frac{88}{2 \times \frac{22}{7}} = 14\ cm$

Surface area of the circle $= \pi\ r^2$

$\simeq \frac{22}{7} \times 14 \times 14 \simeq 616\ cm^2$

8. Circumference $= 2\ \pi\ r = 2 \times 3.14\ r$

then $r = \frac{31.4}{6.28} = 5$, then $\boxed{r = 5\ cm}$

Area of the circle $= \pi\ r^2 = 3.14 \times 5 \times 5 = 78.5\ cm^2$

9. Circumference of the circle $= 2\ \pi\ r$

$62.8 = 2 \times 3.14 \times r$ $62.8 = 6.28\ r$

$r = \frac{62.8}{6.28} = 10$ $\boxed{r = 10\ cm}$

surface area of the circle $= \pi\ r^2 \simeq 3.14 \times 10 \times 10$

$\simeq 314\ cm^2$

10. r = circumference of the circle $\div 2\pi$

$\simeq 44 \div \left(2 \times \frac{22}{7}\right) \simeq 44 \div \frac{44}{7}$

$\simeq 44 \times \frac{7}{44} = 7\ cm$

Surface area of the circle $= \pi\ r^2$

$\simeq \frac{22}{7} \times 7 \times 7 \simeq 154\ cm^2$

11. Since: $\frac{1}{2}$ area of the circle $= 100.48$,

therefore the area of the circle $= 2 \times 100.48$

$= 200.96\ cm^2$

Since surface area of the circle $= \pi\ r^2$

then $r^2 = \frac{200.96}{3.14} \simeq 64$

then $r^2 = 8 \times 8$ $r = 8\ cm$

Circumference $= 2\ \pi\ r = 2 \times 3.14 \times 8 = 50.24\ cm$

12. Area of the square = side $\times$ side $= 14 \times 14$

$= 196\ cm^2$

From the figure: the side length of the square

= the length of the diameter of the circle.

Then $r = \frac{14}{2} = 7\ cm$

Area of the circle $= \pi\ r^2 \simeq \frac{22}{7} \times 7 \times 7 = 154\ cm^2$

Area of the shaded part $\simeq 196 - 154 \simeq 42\ cm^2$

13. Area of the rectangle = length $\times$ width

$= 7 \times 8 = 56\ cm^2$

From the figure the diameter of the circle

$=$ AB $= 7\ cm$, then $r = \frac{7}{2} = 3.5\ cm$

Area of the circle $= \pi\ r^2 = \frac{22}{7} \times 3.5 \times 3.5$

$= 38.5\ cm^2$

Area of the shaded part $= 56 - 38.5 = 17.5\ cm^2$

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14. Area of the circle = $3 \times 37.68 = 113.04\ cm^2$

$r^2 = \frac{113.04}{3.14} = 36\ cm$ $\therefore\ r = 6\ cm$

15. Area of the square = $100\ cm^2$

Area of the circle = $3.14 \times 25 = 78.5\ cm^2$

Area of the shaded part = $100 - 78.5 = 21.5\ cm^2$

16. The width of the rectangle = $\frac{1}{2}$ its length = 10 cm

Area of the shaded part

= area of the rectangle – (2 × area of the circle)

$\simeq (20 \times 10) - (2 \times 3.14 \times 5 \times 5) \simeq 200 - 157$

$\simeq 43\ cm^2$

17. The width of the rectangle = 7 cm

The area of the shaded part

= area of the rectangle $- \frac{1}{2}$ area of the circle

$= (14 \times 7) - \left(\frac{1}{2} \times \frac{22}{7} \times 7 \times 7\right) = 98 - 77 = 21\ cm^2$

18. Area of the square = $7 \times 7 = 49\ cm^2$

Area of the circle $\simeq \frac{22}{7} \times 3.5 \times 3.5 \simeq 38.5\ cm^2$

Area of the shaded part

$= \frac{\text{area of square} - \text{area of circle}}{2}$

$\simeq \frac{38.5 - 49}{2} \simeq 5.25\ cm^2$

19. Since Δ ABC is an equilateral triangle, therefore the length of AC = 21 ÷ 3 = 7 cm

i.e. the diameter of the circle = 7 cm

The area of the semicircle = $\frac{1}{2} \times \frac{22}{7} \times 3.5 \times 3.5$

$= 19.25\ cm^2$

20. a) Area of the circle = 4 × area of one sector

$= 4 \times 346.5 = 1386\ cm$

Area of the circle = $\pi r^2 = 1386 = \frac{22}{7} r^2$

$r^2 = 1386 \times \frac{7}{22} = 441$

$\therefore r^2 = 441 = 21 \times 21$ $\therefore$ r = 21 cm

b) Circumference of the circle = $2 \pi r$

$\simeq 2 \times \frac{22}{7} \times 21 \simeq 132\ cm$

21. Area of the circle = $3.14\ (12.5)2 \simeq 490.625\ cm^2$

The area of one sector = $\frac{490.625}{8} \simeq 61\ cm^2$

22. 23. are left to the student.

24. Area of the shaded part

$\simeq$ area of rectangle ABCD – area of the circle

$\simeq (20 \times 7) - \left(\frac{22}{7} \times \frac{7}{2} \times \frac{7}{2}\right) = 140 - 38.5$

$= 101.5\ cm2$

25. Area of the glass = $3.14 \times (0.75)^2$

$= 1.76625\ m^2$

The cost $\simeq 1.76625 \times 60 =$ L.E. 105.975

26. r = 200 ÷ 2 = 100 cm ÷ 100 = 1 metre

Area of the carpet = $\pi r^2 = 3.14 \times 1 \times 1$

$= 3.14\ m^2$

The price of the carpet = $3.14 \times 50 =$ L.E. 157

27. 1 : 4 : 9

28. Left to the student.

29. Area of one circle = $\pi r^2 = 3.14 \times (10)^2$

$= 314\ cm^2$

Area of the shaded part = $3 \times \frac{1}{6} \times$ area of the circle

$= \frac{1}{2} \times$ area of the circle

$= \frac{1}{2} \times 314 \simeq 157\ cm^2$

30. The area of half of the circle of diameter 28 cm

$= \frac{1}{2} \pi r^2 = \frac{1}{2} \times \frac{22}{7} \times (14)^2$

$\simeq \frac{1}{2} \times 616\ cm^2 = 308\ cm^2$

The area of quarter of the circle of radius 28 cm

$= \frac{1}{4} \times \pi \times r^2 = \frac{1}{4} \times \frac{22}{7} \times (28)^2 = 616\ cm^2$

The area of the shaded part

$\simeq 308 + 308 + 616 + 616 \simeq 1848\ cm^2$

The perimeter of half of the circle of diameter 28 cm

$\simeq \frac{1}{2} \times 2 \times \frac{22}{7} \times 14 \simeq 44\ cm$

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The perimeter of quarter of the circle of radius 28 cm

$\simeq \frac{1}{4} \times 2 \times \frac{22}{7} \times 28 \simeq 44$ cm

$\therefore$ The perimeter of the figure

$\simeq 44 + 44 + 44 + 44 \simeq 176$ cm

31. The area of quarter of the smaller circle

$= \frac{1}{4} \times \frac{22}{7} \times (7)2 = 38.5$ cm^2

The area of quarter of the bigger circle

$= \frac{1}{4} \times \frac{22}{7} \times (14)^2 = 154$ cm^2

The area of the shaded figure =

$= 38.5 + 38.5 + 154 = 231$ cm^2

32. Area of the rhombus

$= \frac{1}{2} \times$ the product of its diagonals

$= \frac{1}{2} \times 44 \times 28 = 616$ cm^2

Therefore the area of the circle = 616 cm^2

r^2 = area of the circle $\div \pi = 616 \div \frac{22}{7} = 196$

$= 14 \times 14$ (r = 14 cm)

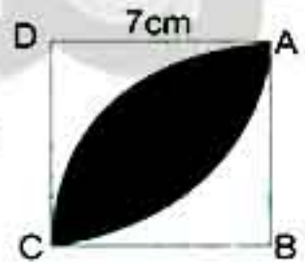
Circumference of the circle = $2\pi r$

$= 2 \times \frac{22}{7} \times 14 = 88$ cm

33. The arc (BD) represents $\frac{1}{4}$ of the circle, r = 7 cm

then $\frac{1}{4} \times 2 \times \pi \times r$

$= \frac{1}{4} \times 2 \times \frac{22}{7} \times 7 = 11$ cm



The perimeter of the shaded part

$= 11 + 11 = 22$ cm

The area of the part D =

area of the quarter of circle – area of Δ BCD

$= \frac{1}{4} \times \frac{22}{7} \times 7 \times 7 - \frac{1}{2} \times 7 \times 7 = 14$ cm^2

Area of the shaded part = 14 + 14 = 28 cm^2

34. The area of the shaded part

= area of half of the circle

$= \frac{1}{2} \times \pi \times r^2 = \frac{1}{2} \times \frac{22}{7} \times (7)^2 = 77$ cm^2

Exercise 4

First: The cube

1. a) The lateral area = $(15 \times 15) \times 4 = 900$ cm^2

Total area = $(15 \times 15) \times 6 = 1350$ cm

b) The lateral area = $(10 \times 10) \times 4 = 400$ cm^2

Total area = $(10 \times 10) \times 6 = 600$ cm^2

c) Left to the student.

2. a) 256 **b)** 144 **c)** 96 **d)** 294

e) 196 **f)** 216 **g)** 600 **h)** 54

i) $\frac{2}{3}$ **j)** 1 : 4 **k)** 150 **l)** 16

m) 1000 **n)** 25

3. a) 64 **b)** $\frac{1}{6}$ **c)** 150

d) area of one face **e)** 54 **f)** 8

g) 180

4. Lateral area of the cube = area of one face × 4

$= 9 \times 4 = 36$ cm^2

5. Left to the student.

6. The length of the edge = $12 \div 12 = 1$ cm

Area of one face = $1 \times 1 = 1$ cm^2

Total area of the cube = $1 \times 1 \times 6 = 6$ cm^2

7. a) The volume = 64 cm3 = $4 \times 4 \times 4$

The length of edge = 4 cm

b) The area of one face of the cube = $4 \times 4 = 16$ cm^2

Lateral area of the cube = $4 \times 4 \times 4 = 64$ cm^2

Total area of the cube = $4 \times 4 \times 6 = 96$ cm^2

8. Area of one face of the cube = Lateral area $\div 4$

$= 36 \div 4 = 9$ cm^2

$= 3 \times 3$

The length of the edge = 3 cm

Total area of the cube = area of one face × 6

$= 9 \times 6 = 54$ cm^2

Volume of the cube = edge × edge × edge

$= 3 \times 3 \times 3 = 27$ cm^3

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9. Edge length = 20 ÷ 4 = 5 cm

Total area = 5 × 5 × 6 = 150 cm^2

10. a) Area of one face = total area ÷ 6

= 726 ÷ 6 = 121 cm^2

b) The length of each edge = 11 cm

c) The lateral area of the cube

= Area of one face × 4

= 121 × 4 = 484 cm^2

11. 2 : 3

12. The length of the edge = 48 ÷ 4 = 12 cm

Total area of the cube without a lid

= edge × edge × 5

= 12 × 12× 5 = 720 cm^2

13. Total area of the store = 1.5 × 1.5 × 6 = 13.5 m^2

The cost of painting = 13.5 × 20 = L.E. 270

14. The area of painting = 4 × 4 × 5 = 80 cm^2

The cost of painting = 80 × 9 = L.E. 720

15. Area of the rectangle = length × width

= 120 × 80 = 9600 cm^2

Total area of the cube = 30 × 30 × 6

= 5400 cm^2

Area of the remaining part of paper

= 9600 – 5400 = 4200 cm^2

16. Left to the student.

Second: The cuboid

17. a) The lateral area = (12 + 20) × 2 × 17

= 1088 cm^2

Area of the two bases = 12 × 20 × 2

= 480 cm^2

Total area = 1088 + 480 = 1568 cm^2

b) The lateral area = (20 + 15) × 2 × 10

= 700 cm^2

Area of the two bases = 20 × 15 × 2

= 600 cm^2

Total area = 700 + 600 = 1300 cm^2

c) The lateral area = 8 × 4 × 20 = 640 cm^2

Area of the two bases = 8 × 8 × 2 = 128 cm^2

Total area = 640 + 128 = 768 cm^2

d) Left to the student.

18. a) Perimeter of base × height

b) Lateral area + sum of areas of two bases

c) (3 + 2) × 2 × 4 = 5 × 2 × 4 = 40 cm^2

d) The lateral area = (16 + 4) × 2 × 10 = 400 cm^2

e)The lateral area = 24 × 13 = 312 cm^2

f) The height = 130 ÷ 26 = 5 cm

g) The total area = 36 + (18 × 2) = 72 cm^2

h) Area of the two bases = 150 – 90 = 60 cm^2

Area of the base = 60 ÷ 2 = 30 cm^2

i) The height = $\frac{120 - (4 \times 6 \times 2)}{(4 + 6)^2}$ = 3.6 cm

19. The lateral area = (5 + 7) × 2 × 9 = 216 cm^2

Area of the two bases = 7 × 5 × 2 = 70 cm^2

Total area = 216 + 70 = 286 cm^2

20. The lateral area = (16 + 7) × 2 × 19 = 874 cm^2

Area of the base = 16 × 7 = 112 cm^2

Total area = 874 + 112 = 986 cm^2

21. The height = 3 × 10 = 30 cm

The lateral area = (20 + 10) × 2 × 30 = 1800 cm^2

Area of the base = 20 × 10 = 200 cm^2

Total area = 1800 + 200 = 2000 cm^2

22. The lateral area = 9 × 4 × 20 = 720 cm^2

Area of the two bases = 9 × 9 × 2 = 162 cm^2

Total area = 720 + 162 = 882 cm^2

23. The lateral area of the cube = 10 × 10 × 4

= 400 cm^2

The lateral area of the cuboid = (8 + 5) × 2 × 17

= 442 cm^2

The difference between the two lateral areas

= 442 – 400 = 42 cm^2

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24. The lateral area = $12 \times 4 \times 9 = 432\ cm^2$

Area of the base = $12 \times 12 = 144\ cm^2$

Total area = $432 + 144 = 576\ cm^2$

25. The lateral area = $(40 + 10) \times 2 \times 2.5 = 250\ m^2$

Area of the base = $40 \times 10 = 400\ cm^2$

The total area = $250 + 400 = 650\ cm^2$

26. The lateral area = $(5 + 2.5) \times 2 \times 1.6 = 24\ m^2$

Area of the base = $5 \times 2.5 = 12.5\ m^2$

The total area wanted to be painted = $24 + 12.5 = 36.5\ cm^2$

The cost of painting = $36.5 \times 12 =$ L.E. 438

27. The lateral area = $(4 + 2.5) \times 2 \times 1.8 = 23.4\ m^2$

Area of the base = $4 \times 2.5 = 10\ m^2$

The total area that should be covered

$= 23.4 + 10 = 33.4\ m^2$

The cost of the needed sheet of iron

$= 33.4 \times 15 =$ L.E. 501

28. Left to the student.

29. The lateral area = $(5 + 4) \times 2 \times 3.2 = 57.6\ m^2$

Area of the ceiling = $5 \times 4 = 20\ m^2$

Lateral area and the ceiling = $57.6 + 20 = 77.6\ m^2$

The total area that should be painted = $77.6 - 8 = 69.6\ m^2$

The cost of painting = $69.6 \times 8 =$ L.E. 556.8

30. The lateral area = $4 \times 4 \times 3 = 48\ m^2$

Area of the door = $0.9 \times 2 = 1.8\ m^2$

Area of the window = $1.6 \times 1 = 1.6\ m^2$

The open area = $1.8 + (2 \times 1.6)\ m = 5\ m^2$

The area that should be painted = area of the walls – Open area = $48 - 5 = 43\ m^2$

The cost of painting = $43 \times 9 =$ L.E. 387

31. The lateral area = $(30 + 10) \times 2 \times 1.5 = 120\ m^2$

Area of the base = $30 \times 10 = 300\ m^2$

The total area = $120 + 300 = 420\ m^2$

Area of ceramic tiles = $0.2 \times 0.2 = 0.04\ m^2$

The number of needed ceramic tiles

$= 420 \div 0.04 = 10500$ tiles

32. The height = $\frac{120}{(13 + 7) \times 2} = 3$ cm

33. The perimeter of the base = $\frac{224}{14} = 16$ m

The length of the base side = $16 \div 4 = 4$ cm

34. a) The lateral area of the cuboid = $90 \times 15 = 1350\ cm^2$

Width of the rectangle = $\frac{90}{2} - 30 = 15$ cm

Area of the two bases = $30 \times 15 \times 2 = 900\ cm^2$

b) The total area of the cuboid = $1350 + 900 = 2250\ cm^2$

35.

Length	:	Width	:	Perimeter
5	:	3	:	16
?	:	?	:	80

Length = $\frac{5 \times 80}{16} = 25$ cm

Width = $\frac{3 \times 80}{16} = 15$ cm

The lateral area = $80 \times 10 = 800\ cm^2$

Area of the bases = $25 \times 15 \times 2 = 750\ cm^2$

Total area = $800 + 750 = 1550\ cm^2$

36, 37 and 38 are left to the student.

39. a) cube **b)** $6 \times 6 \times 4 = 144\ cm^2$

c) $6 \times 6 \times 6 = 216\ cm^2$

40. Left to the student.

41.

Length	:	Width	:	Height	:	Sum
3	:	2	:	4	:	9
						45

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Length $= \frac{3 \times 45}{9} = 15$ cm

Width $= \frac{2 \times 45}{9} = 10$ cm

Height $= \frac{4 \times 45}{9} = 20$ cm

The lateral area of the cuboid

$= (15 + 10) \times 2 \times 20 = 1000$ cm^2

42. Height $= 1.2 \times 10 = 12$ cm

$\therefore$ sum of heights $= 12 \times 4 = 48$ cm

$\therefore$ sum of four widths and four lengths

$= 176 - 48 = 128$ cm

$4L + 4W = 128 \therefore L + W = 128 \div 4 = 32$ cm

	L	:	W	:	Sum
Ratio	3	:	1	:	4
Real	24	:	8	:	32

$\therefore$ Total surface area

= lateral area + 2 × base area

= (base perimeter × h) + 2 × base area

$= (8 + 24) \times 2 \times 12 + (2 \times 8 \times 24)$

$= 64 \times 12 + 384 = 768 + 384 = 1152$ cm^2

43. The total area of the remaining part

= total area of the cuboid

$= (20 + 10) \times 2 \times 5 + 20 \times 10 \times 2$

$= 300 + 400 = 700$ cm^2

The volume of the remaining part

= volume of the big cuboid – volume of the small one

$= 20 \times 10 \times 5 - 3 \times 2 \times 1$

$= 1000 - 6 = 994$ cm^2

Answers of selected problems from previous exams on Unit 3

1. a) 216 **b)** 54 **c)** 16

d) 4 **e)** (0 , 1)

2. a) 54 **b)** 154 **c)** (2, 1)

d) πr^2 **e)** 88

3. Area of the rectangle $= 10 \times 7 = 70$ cm^2

Area of the circle $= \frac{22}{7} \times (3.5)^2 = 38.5$ cm^2

The area of the total shape $= 70 + 38.5$

$= 108.5$ cm^2

4. a) Area of the circle $= 3.14 \times 4 \times 4 = 50.25$ cm^2

b) Area of one sector $= 50.24 \div 8 = 6.28$ cm^2

5. Area of the square $= 20 \times 20 = 400$ cm^2

Area of the circle $= 3.14 \times (10)^2 = 314$ cm^2

The area of the shaded part $= 400 - 314$

$= 86$ cm^2

6. Left to the student.

7. Left to the student.

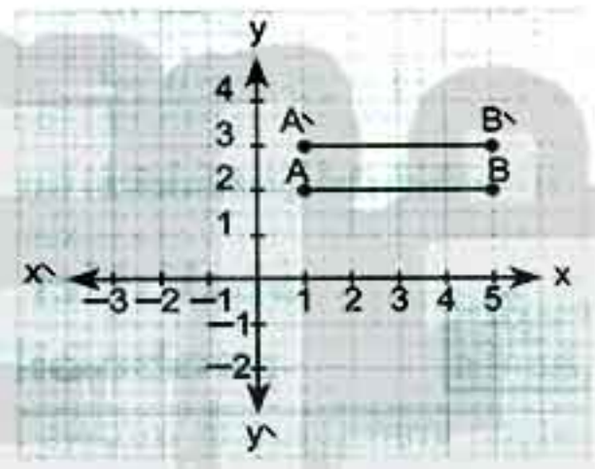
8. 1st: the area of one face

$= 486 \div 6 = 81$ cm^2

2nd: the lateral area $= 81 \times 4 = 324$ cm^2

9. Left to the student.

10. AB $= 5 - 1 = 4$ units



A` = (1, 2) + (0, 1) = (1, 3)

B` = (5, 2) + (0, 1) = (5, 3)

$\overline{A`B`}$ is the image of $\overline{AB}$ by translation (0, 1)

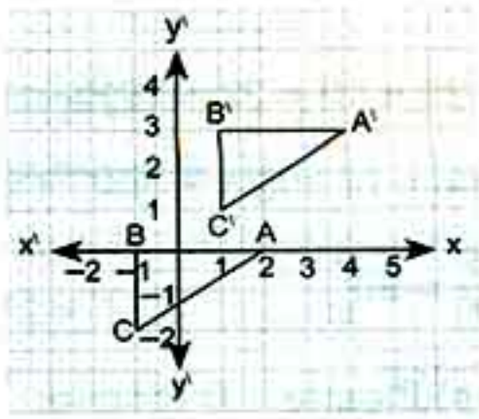
Test on UNIT 3 from the School Book

1. a) A (2, 0), B (–1, 0) C (–1 , – 2)

b) A (2, 0) $\xrightarrow{(2, 3)}$ A` (4, 3)

B (–1, 0) $\xrightarrow{(2, 3)}$ B` (1, 3)

C (–1, –2) $\xrightarrow{(2, 3)}$ C` (1, 1)



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c) BC = |–2 –0| = |–2| = 2 length units

AB = |–1 –2| = |–3| = 3 length units

d) Not symmetric because it's a scalene triangle.

2. Area of the circle = πr^2

$\simeq 3.14 \times 5 \times 5 \simeq 78.5\ cm^2$

Area of the rectangle = L × W

$= 8 \times 6 = 48\ cm^2$

Area of the shaded part $\simeq 78.5 - 48 = 30.5\ cm^2$

3. The length of edge = 72 ÷ 12 = 6 cm

The lateral area = $6 \times 6 \times 4 = 144\ cm^2$

The lateral area = $6 \times 6 \times 6 = 216\ cm^2$

4. The lateral area = $(7 + 5) \times 2 \times 3.5 = 84\ m^2$

Area of the ceiling = $7 \times 5 = 35\ m^2$

The total area = $84 + 35 = 119\ m^2$

The total cost price = 119 × 11 = L.E. 1309

UNIT 4 Statistics and probability

Exercise 1

1. a) 360 **b)** 180° **c)** 120° **d)** 45°

e) $\frac{1}{8}$ **f)** $\frac{1}{2}$ **g)** 20° **h)** $\frac{1}{6}$

2. a) 40 **b)** 25 **c)** 100° – (40° + 25°) = 35°

d) $360° \times \frac{40}{100} = 144°$ **e)** $360° \times \frac{25}{100} = 90°$

f) $360° \times \frac{35}{100} = 126°$

3. a) $360° \times \frac{22}{100} = 79.2°$

b) 100% – (25 + 18 + 22 + 22)% = 13%

The measure of angle = $360° \times \frac{13}{100} = 46.8°$

c) $360° \times \frac{25}{100} = 90°$

d) 79.2° **e)** theatre **f)** rangers

4.

Type of the set	The percentage	The number of the sets	The measure of the central angle
TV	35%	$\frac{4000 \times 35}{100} = 1400$	$\frac{35}{100} \times 360° = 126°$
Washing machine	25%	$\frac{4000 \times 25}{100} = 1000$	$\frac{25}{100} \times 360° = 90°$
Refrigerator	15%	$\frac{4000 \times 15}{100} = 600$	$\frac{15}{100} \times 360° = 54°$
Cooker	25%	$\frac{4000 \times 25}{100} = 1000$	$\frac{25}{100} \times 360° = 90°$

5. a) The number of good students = $\frac{108°}{360°} \times 200$

= 100 students

Its percentage = $\frac{180}{360} \times 100 = 50\%$

b) The number of the students who pass in this school = $\frac{90°}{360°} \times 200 = 50$ students

c) The number of excellent students in this school

$= \frac{54°}{360°} \times 200 = 30$ students

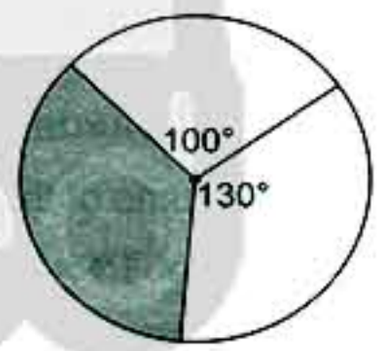
Its percentage = $\frac{54°}{360°} \times 100 = 15\ \%$

d) $360° - (180° + 90° + 54°) = 36°$

6. The measure of central angle of the shaded circular sector

= 360° – (100° + 130°)

= 130°



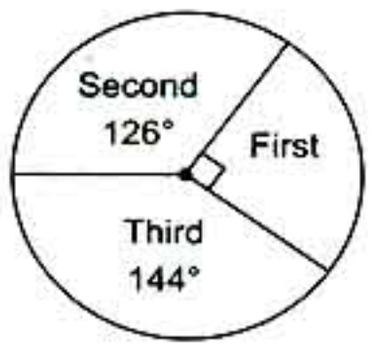
7. The measure of the first angle = $\frac{25}{100} \times 360° = 90°$

The measure of the second angle = $\frac{35}{100} \times 360°$

= 126°

The measure of the third angle = $\frac{40}{100} \times 360°$

= 144°



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8. The measure of the first angle $= \frac{15}{100} \times 360°$
$= 54°$

The measure of the second angle $= \frac{20}{100} \times 360°$
$= 72°$

The measure of the third angle $= \frac{35}{100} \times 360°$
$= 126°$

The measure of the fourth angle $= \frac{30}{100} \times 360°$
$= 108°$



a) The first $= \frac{15}{100} \times 20$ million $= 3$ million

The second $= \frac{20}{100} \times 20$ million $= 4$ million

The third $= \frac{35}{100} \times 20$ million $= 7$ million

The fourth $= \frac{30}{100} \times 20$ million $= 6$ million

b) The descending order is: third, fourth, second, first.

9. a) The percentage of sport $= \frac{70}{200} \times 100° = 35\%$

The percentage of news $= \frac{20}{200} \times 100° = 10\%$

The percentage of drama $= \frac{40}{200} \times 100° = 20\%$

The percentage of movies $= 20\%$

The percentage of songs $= \frac{30}{200} \times 100° = 15\%$

b) The measure of the central angle of sport
$= \frac{35}{100} \times 360° = 126°$

The measure of the central angle of news
$= \frac{10}{100} \times 360° = 36°$

The measure of the central angle of drama
$= \frac{20}{100} \times 360° = 72°$

The measure of the central angle of movies $= 72°$

The measure of the central angle of songs
$= \frac{15}{100} \times 360° = 54°$



10. a) The sum of the students $= 9 + 5 + 4 + 7 + 11$
$= 36$

b) The measure of the central angle of entertainment
$= \frac{9}{36} \times 360° = 90°$

The measure of the central angle of culture
$= \frac{5}{36} \times 360° = 50°$

The measure of the central angle of news
$= \frac{4}{36} \times 360° = 40°$

The measure of the central angle of drama
$= \frac{7}{36} \times 360° = 70°$

The measure of the central angle of sports
$= \frac{11}{36} \times 360° = 110°$



The most favourite is sports.

The least favourite is news.

11. a) The savings $= 100\% - (40\% + 20\% + 30\%)$
$= 10\%$

The measure of the central angle of the food
$= \frac{40}{100} \times 360° = 144°$

The measure of the central angle of the house rent $= \frac{20}{100} \times 360° = 72°$

The measure of the central angle of expenses
$= \frac{30}{100} \times 360° = 108°$

The measure of the central angle of savings
$= \frac{10}{100} \times 360° = 36°$



The savings of the family in month
$= \frac{10}{100} \times 900 =$ L.E. 90

The savings of the family in the year
$= 90 \times 12 = 1080$ pounds.

b) The salary of the family $= \frac{100}{10} \times 70 =$ L.E. 700

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12. The total production = 720 + 3600 + 1080 + 1800

= 7200

The measure of the first angle

$= \frac{720}{7200} \times 360° = 36°$

The measure of the second angle

$= \frac{3600}{7200} \times 360° = 180°$

The measure of the third angle

$= \frac{1080}{7200} \times 360° = 54°$

The measure of the fourth angle

$= \frac{1800}{7200} \times 360° = 90°$



a) The second factory satisfies more production.

b) The percentage of production of the first factory

$= \frac{720}{7200} \times 100 = 10\%$

The percentage of production of the second factory $= \frac{3600}{7200} \times 100 = 50\%$

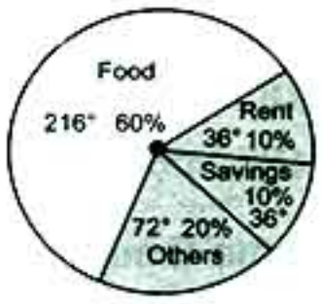
The percentage of production of the third factory $= \frac{1080}{7200} \times 100 = 15\%$

The percentage of production of the fourth factory $= \frac{1800}{7200} \times 100 = 25\%$

13. The percentage of savings

= 100% – (10% + 60% + 20%) = 10%

The measures of angles are **left to the student.**



14.

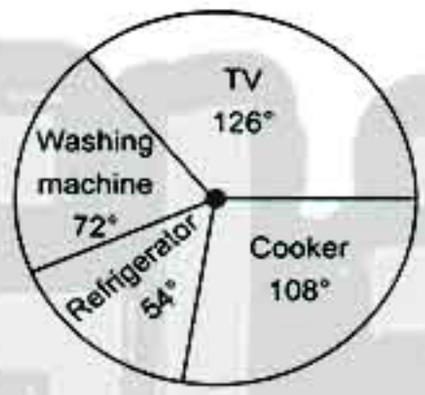
The components of the earth's surface	Water natural supplies	Valleys	Hills	Mountains
The percentage of each component	71%	13%	6%	10%

a) The component which represents the smallest ratio of the earth's surface is the hills.

b) The component which represents the greatest ratio of the earth's surface is the water.

c) The measure of the central angle of the sector of valleys $= \frac{13}{100} \times 360° = 46.8$

15.



The central angle which represents TV

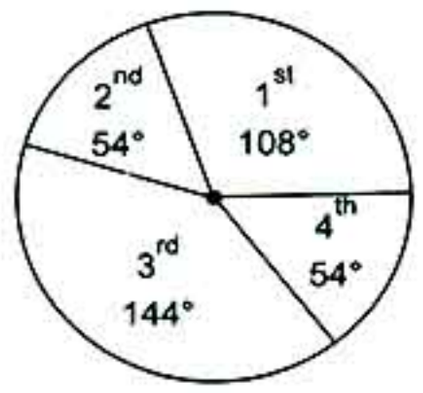
$= \frac{35}{100} \times 360° = 126°$

Washing machine $= \frac{20}{100} \times 360° = 72°$

Refrigerator $= \frac{15}{100} \times 360° = 54°$

Cooker $= \frac{30}{100} \times 360° = 108°$

16.



The central angle which represents

1^{st} kind $= \frac{30}{100} \times 360° = 108°$

2^{nd} kind $= \frac{15}{100} \times 360° = 54°$

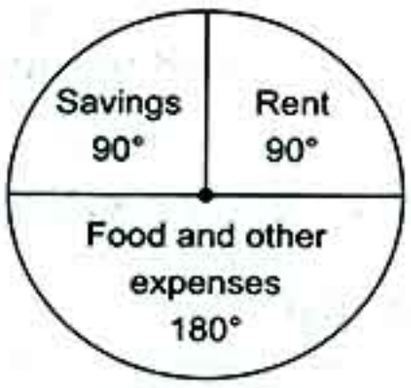
3^{rd} kind $= \frac{40}{100} \times 360° = 144°$

4^{th} kind $= \frac{15}{100} \times 360° = 54°$

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17.



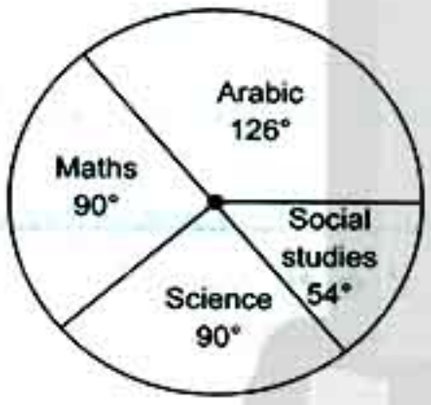
The central angle that represents

Rent = $\frac{25}{100} \times 360° = 90°$

Food and other expenses = $\frac{50}{100} \times 360° = 180°$

Savings = $\frac{25}{100} \times 360° = 90°$

18.



The central angle which represents

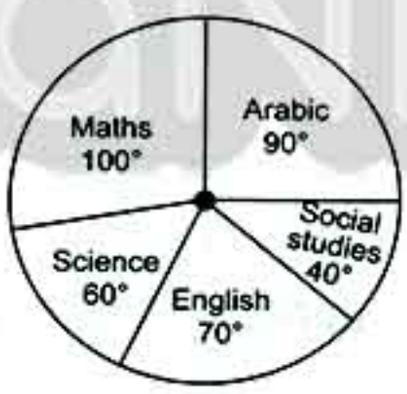
Arabic = $\frac{35}{100} \times 360° = 126°$

Maths = $\frac{25}{100} \times 360° = 90°$

Science = $\frac{25}{100} \times 360° = 90°$

Social studies = $\frac{15}{100} \times 360° = 54°$

19.



The central angle which represents

Arabic = $\frac{9}{36} \times 360° = 90°$

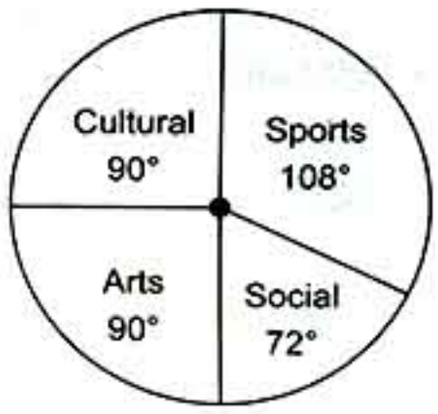
Maths = $\frac{10}{36} \times 360° = 100°$

Science = $\frac{6}{36} \times 360° = 60°$

English = $\frac{7}{36} \times 360° = 70°$

Social studies = $\frac{4}{36} \times 360° = 40°$

20.



The central angle which represents

Cultural = $\frac{25}{100} \times 360° = 90°$

Sports = $\frac{30}{100} \times 360° = 108°$

Social = $\frac{20}{100} \times 360° = 72°$

Arts = $\frac{25}{100} \times 360° = 90°$

21.



The central activity angle which represents

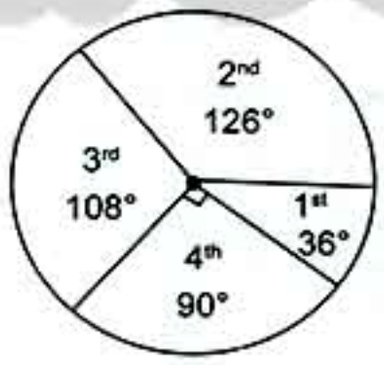
The angle of sector of football = $\frac{50}{100} \times 360°$
= 180°

The angle of sector of basketball = $\frac{20}{100} \times 360°$
= 72°

The angle of sector of handball = $\frac{30}{100} \times 360°$
= 108°

22. a) 25%

b)



The central angle which represents

1st farm = $\frac{10}{100} \times 360° = 36°$

2nd farm = $\frac{35}{100} \times 360° = 126°$

3rd farm = $\frac{30}{100} \times 360° = 108°$

4th farm = $\frac{25}{100} \times 360° = 90°$

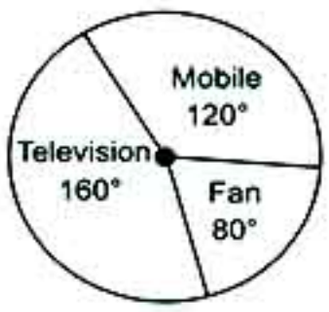
The most productive farm is the second one.

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23 and 24 are left to the student.

25.

Mobile	:	Television	:	Fan	:	Sum
3	:	4	:	2	:	9
120°		160°		80°		360°



Exercise 2

1. a) An experiment which we can determine all its outcomes before carrying it but we cannot predict which of them will occur exactly.

b) The sample space: it is the set which contains all possible outcomes of the random experiment.

c) {red, green, blue}, n (S) = 3

d) S = {(H, H), (H, T), (T, H), (T, T)}, n (S) = 4

e) S = {1, 2, 3, 4, 5, 6}, n (S) = 6

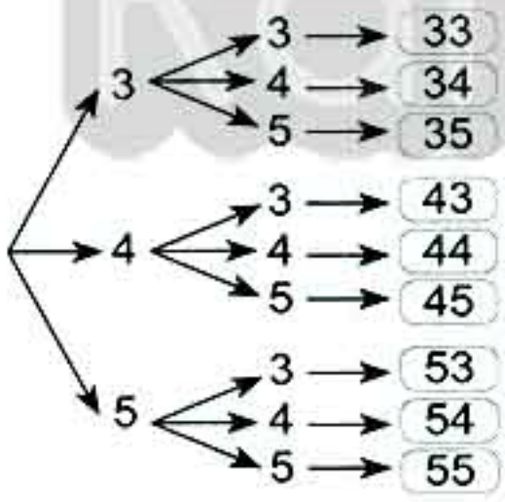
f) S = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}, n (S) = 10

g) S = {1, 2, 3, ..., 20}, n (S) = 20

2. {boy, girl}

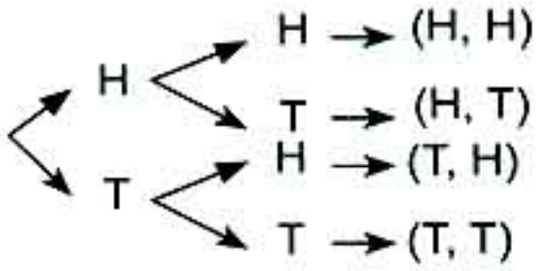
3. {red, yellow, green, blue}

4.



S = {33 , 34 , 35 , 43 , 44 , 45 , 53 , 54 , 55}

5.



S = {(H, H), (H ,T) , (T ,H), (T, T)}

6. S = {1, 2, 3, 4, 5, 6, 7, 8, 9}.

7. Red balls are represented by r and yellow balls are represented by y.

S = {r_1 , r_2 , r_3 , y_1 , y_2 , y_3 , y_4}, n (s) = 6 elements

8. S = {33, 38, 83, 88}.

9. S = {5, 10, 15, 20, 25, 30, 35, 40, 45, 50}.

10. S = {1, 2, 3, 4, 5, 6}. n (s) = 6 elements

11. White balls are represented by W and red balls are represented by r.

S = {W_1 , W_2 , W_3 , W_4 , W_5 , r_1 , r_2 , r_3 , r_4 , r_5 , r_6 , r_7 , r_8 , r_9}.

12. S = {10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20}. n (S) = 11

13. S = {a, b, c, d, e, f}.

14. S = {A, I, i}.

Exercise 3

1. a) zero, 1 **b)** 0,1 **c)** $\frac{1}{2}$ **d)** $\frac{6}{15} = \frac{2}{5}$

e) zero **f)** $\frac{7}{15}$ **g)** zero **h)** $\frac{2}{7}$

i) $\frac{1}{2}$ **j)** $\frac{3}{5}$ **k)** $\frac{3}{7}$ **l)** 35% **m)** $\frac{4}{9}$

2. a) zero **b)** 1 **c)** 75% **d)** 24%

e) $\frac{1}{3}$ **f)** $\frac{3}{20}$ **g)** $\frac{3}{8}$ **h)** zero

i) $\frac{1}{2}$ **j)** zero **k)** $\frac{1}{2}$ **l)** 0.3

3. S = {1, 2, 3, 4 , 5 , 6 , 7}.

a) P (A) = $\frac{3}{7}$ **b)** P (B) = $\frac{4}{7}$ **c)** P (C) = $\frac{2}{7}$

4. a) $\frac{2}{5}$ **b)** $\frac{3}{5}$ **c)** zero

5. a) P (A) = $\frac{35}{40} = \frac{7}{8}$ **b)** P (B) = $\frac{32}{40} = \frac{4}{5}$

c) P (C) = $\frac{8}{40} = \frac{1}{5}$

6. S = {4 , 6 , 8 , 10 , 12 , 14 , 16, 18}.

Therefore n (S) = 8

a) A = {4, 8, 12, 16} therefore P (A) = $\frac{4}{8} = \frac{1}{2}$

b) P (B) = $\frac{8}{8} = 1$

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c) C = {6, 12, 18}

therefore n (C) = 3 therefore P(C) = $\frac{3}{8}$

7. S = {1, 2, 3, 4, 5, 6}

a) Event A = {1, 2, 3}

n (A) = 3 therefore P(A) = $\frac{3}{6} = \frac{1}{2}$

b) Event B = {1, 2, 3, 4, 5}

n (B) = 5 therefore P(B) = $\frac{5}{6}$

8. a) S = {2 , 4 , 6} **b)** $\frac{2}{6} = \frac{1}{3}$ **c)** 1

9. a) $\frac{2}{6} = \frac{1}{3}$ **b)** $\frac{2}{6} = \frac{1}{3}$ **c)** $\frac{1}{6}$

The probability that the pointer doesn't stop at the green colour = $\frac{5}{6}$

10. a) The number of white balls = $48 \times \frac{5}{6} = 40$

b) 1) The event is the sum of the two numbers more than 10 = {(5, 6), (6,5), (6,6)}.

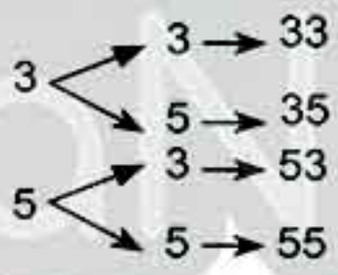
The probability of this event = $\frac{3}{36} = \frac{1}{12}$

2) The event is {(1 , 1), (1 , 2), (2 , 1)}.

The probability = $\frac{3}{36} = \frac{1}{12}$ = the event.

11. a) $\frac{6}{20} = \frac{3}{10}$ **b)** zero **c)** $\frac{12}{20} = \frac{6}{10} = \frac{3}{5}$

12. S is the sample space.



S = {33, 53, 35, 55}

a) Event A = {33, 55} , P (A) = $\frac{2}{4} = \frac{1}{2}$

b) Event B = {33, 53, 35, 55} , P (B) = $\frac{4}{4} = 1$

c) Event C = ∅ , P (C) = zero

13. S = {1, 2, 3, ..., 20}.

a) Event A = {1, 3, 5, 7, 11, 9, 13, 15, 17, 19}.

P (A) = $\frac{10}{20} = \frac{1}{2}$

b) Event B = {2, 4, 6, 8, 12,10, 14, 16, 18, 20}.

P (B) = $\frac{1}{2}$

c) Event C = {2, 3, 5, 7, 11, 13, 17, 19}.

P (C) = $\frac{8}{20} = \frac{2}{5}$

d) Event F = {5, 10 , 15 , 20}. P (F) = $\frac{4}{20} = \frac{1}{5}$

e) Event G = {3, 6, 9, 12 , 15, 18}. P (G) = $\frac{6}{20} = \frac{3}{10}$

f) Event H = {1, 2, 3, 4, 6, 12}. P (H) = $\frac{6}{20} = \frac{3}{10}$

14. S = {1, 2, 3, 4, 5, 6}.

Event A = {1 , 2 , 3}, P (A) = $\frac{3}{6} = \frac{1}{2}$

15. a) The probability of entrance of a lady of weight less than 110 kg = $\frac{4}{10} = \frac{2}{5} = 0.4 = 40\%$

b) The probability of entrance of a lady of weight more than 110 kg = $\frac{6}{10} = \frac{3}{5} = 0.6 = 60\%$

c) The probability of entrance of a lady of weight 90 kg = zero.

16. a) The probability of being a white ball = $\frac{4}{10} = \frac{2}{5}$

b) The probability of not being white = $\frac{6}{10} = \frac{3}{5}$

17. S = {77, 78, 87, 88}.

a) The probability of event A = $\frac{2}{4} = \frac{1}{2}$

b) The probability of event B = $\frac{2}{4} = \frac{1}{2}$

c) The probability of event C = $\frac{2}{4} = \frac{1}{2}$

18. The sample space = {1, 2, 3, 4, 5, 6}.

a) The probability of getting a number greater than 6 is zero.

b) The probability of getting a number satisfying the inequality $3 < x < 5$ equals $\frac{1}{6}$

19. S = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15}.

a) The probability that the chosen ball carries an odd number = $\frac{8}{15}$

b) The probability that the chosen ball carries a prime number = $\frac{6}{15} = \frac{2}{5}$

c) The probability that the chosen ball carries a number divisible by 3 = $\frac{5}{15} = \frac{1}{3}$

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20. S = {12, 21, 23, 32, 13, 31}.

a) The probability of getting an odd prime number = $\frac{3}{6} = \frac{1}{2}$

b) The probability of getting an even number = $\frac{2}{6} = \frac{1}{3}$

21. The number of red balls = $\frac{2}{3} \times 120 = 80$ balls.

22. The number of men in this meeting = $\frac{2}{5} \times 75 = 30$ men

The number of women in this meeting = $75 - 30 = 45$ women

23. The number of girls = $\frac{4}{9} \times 63 = 28$ girls

24. S = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}.

a) The probability of event A = $\frac{3}{10}$

b) The probability of event B = $\frac{5}{10} = \frac{1}{2}$

c) The probability of event C = $\frac{10}{10} = 1$

d) The probability of event D = $\frac{1}{10}$

25. a) $\frac{25}{500} = \frac{1}{20}$ **b)** $\frac{90}{500} = \frac{9}{50}$

c) $\frac{165}{500} = \frac{33}{100}$ **d)** $\frac{130}{500} = \frac{13}{50}$

e) $\frac{90}{500} = \frac{9}{50}$

26. a) $\frac{18}{24} = \frac{3}{4}$ **b)** $\frac{20}{30} = \frac{2}{3}$ **c)** $\because \frac{3}{4} > \frac{2}{3}$

d) $\therefore$ 1st player should be chosen.

27, 28 Left to the student.

29. 1) a) P (weak student student) = $\frac{5}{40} = \frac{1}{8}$

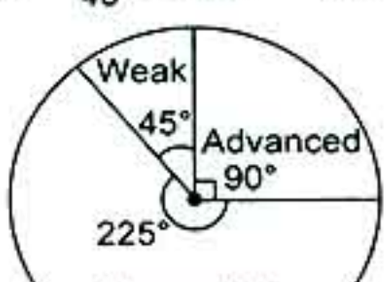
b) P (advanced student) = $\frac{10}{40} = \frac{1}{4}$

c) P (intermediate student) = $\frac{25}{40} = \frac{5}{8}$

2) First angle = $\frac{5}{40} \times 360° = 45°$

Second angle = $\frac{25}{40} \times 360° = 225°$

Third angle = $\frac{10}{40} \times 360° = 90°$



30. P (boys) + P (girls) = 1

$\frac{n\text{ (girls)} + 12}{40} + \frac{n\text{ (girls)}}{40} = 1$

$\frac{2\ n\text{ (girls)} + 12}{40} = 1$

$2\ n\text{ (girls)} + 12 = 40$

$2\ n\text{ (girls)} = 40 - 12 = 28$

$n\text{ (girls)} = 14$ P (girls) = $\frac{14}{40} = \frac{7}{20}$

Answers of selected problems from previous exams on Unit 4

1, 2 and 3 are left to the student.

4. 1) $\frac{1}{2}$ **2)** 130° **3)** $\frac{3}{16}$ **4)** $\frac{1}{3}$

5) 360° **6)** 45° **7)** 40

5. 1) $\frac{1}{6}$ **2)** $\frac{1}{6}$ **3)** 1 **4)** 0

5) 180°

6. a) $\frac{4}{10} = \frac{2}{5}$ **b)** $1 - \frac{2}{5} = \frac{3}{5}$ **c)** zero

7. S = { 1 , 2 , 3 , ..., 15}

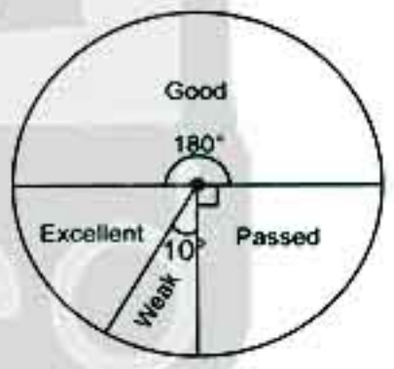
a) $\frac{6}{15} = \frac{2}{5}$ **b)** $\frac{3}{15} = \frac{1}{5}$

8. The measure of the angle for Excellent = $\frac{15}{100} \times 360 = 54°$

, The measure of the angle for Good = $\frac{50}{100} \times 360 = 180°$

The measure of the angle for Passed = $\frac{25}{100} \times 360 = 90°$

The measure of the angle for Weak = $\frac{10}{100} \times 360 = 36°$



9 , 10 and 11 are left to the student.

Test on UNIT 4 from the School Book

1. The measure of the first angle = $360 \times \frac{45}{100} = 162°$

The measure of the second angle = $360 \times \frac{9}{100} = 32.4°$

The measure of the third angle = $360 \times \frac{24}{100} = 86.4°$

The measure of the fourth angle = $360 \times \frac{10}{100} = 36°$

The measure of the fifth angle = $360 \times \frac{12}{100} = 43.2°$

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2. The number of men = $100 \times \frac{3}{5} = 60$ men

The number of women = $100 - 60 = 40$ women

3. Left to the student.

4. a) The event of appearance of a number less than 4 = {1, 2, 3}, n (S) = 6

P (the event) = $\frac{3}{6} = \frac{1}{2}$

b) The event of the appearance of a number less than 6 and more than (1) = {2, 3, 4, 5},

P (the event) = $\frac{4}{6} = \frac{2}{3}$

5. P (A) = $\frac{30}{40} = \frac{3}{4} = 75\%$ P (B) = $\frac{10}{40} = \frac{1}{4} = 25\%$

Answer of TIMSS Questions

1. Thursday **2.** 325

3. 12 pounds **4.** 15 days **5.** 37 pounds

6. The girl gained 100 pounds.

7. 17 coins of 5 piasters, 13 coins of 25 piasters.

8. 144 **9.** 154 **10.** 200

11. $\frac{11}{16}$ **12.** 60 **13.** 24 or 24 km/hr

14. $\frac{5}{6}$ **15.** 298

16. 18 students **17.** 14000 pounds

18. 10 minutes **19.** A = 3 , B = 8

20. 11 **21.** 5 **22.** 180 pounds

23. 60 **24.** $\frac{12}{29}$ **25.** 15 , 21 , 35

26. A = 7 **27.** 15 small boxes, 2 big boxes

28. 186 women

Answer Guide of the Worksheets

Worksheets on Unit (1)

Worksheet 1

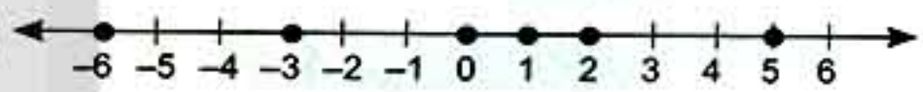
1. a) $\in$ **b)** 5 **c)** $\varnothing$

d) Z **e)** Z^+

2. a) N **b)** 5 **c)** $\notin$

d) {–3} or $\varnothing$ **e)** 4

3. a)



b)



4. a) $|-4| \times |7| = 4 \times 7 = 28$

b) $|-30| \div |-5| = 30 \div 5 = 6$

5. a) –5

b) Z – {7 , –7 , 3} or any integer except 7 , –7 or 3

Worksheet 2

1. a) –41, –40, –39 **b)** 7 **c)** –15 , 15

d) < **e)** zero

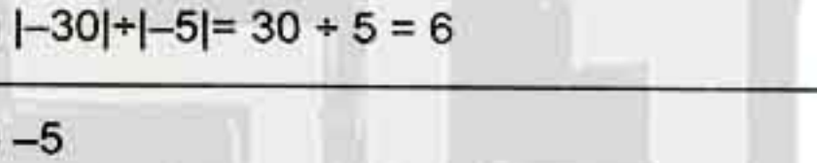
2. a) $\not\subset$ **b)** 1 **c)** 5

d) $\in$ **e)** –3

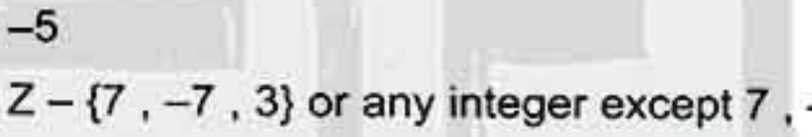
3. 1) 4 , 3 , |–2| , zero and –2

2) |–7| , 5 , |–2| , zero and –3

4. 1)



2)



5. 1) $x = 2 + 3 = 5$

2) $|x| = 3 + 5 = 8$ $x = 8$ or -8

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Worksheet 3

1. a) –3 **b)** –11 **c)** –1 **d)** –2
e) 36 **f)** $\mathbb{Z}$

2. a) 2 **b)** > **c)** ∅ **d)** $\mathbb{N}$
e) –5 **f)** –4

3. a) 1) [(–240) + 140] + 34 = (–100) + 34 = –66
Commutative and associative properties
2) [(1035 + (–1000)] + 75 = [35 + 75] = 110
Commutative and associative properties
b) 2 + 2 = 4 ∉ X, the addition is not closed in X
(–2) – 2 = –4 ∉ X, the subtraction is not closed in X

4. a) 1) –7 **(2)** zero **b) 1)** 1 **2)** –11

5. Left to the student.

Worksheet 4

1. a) –6 **b)** 2 **c)** –3
d) 63 **e)** 21 **f)** –5

2. a) $\mathbb{Z}$ **b)** 9 **c)** –9
d) –1 **e)** 20

3. a) 2 (3) + (–1) – (–7) = 6 + (–1) + 7 = 12
b) 5 × (–11) + (–3) × (–11) = (–55) + 33 = –22
or 2 × (–11) = –22

4. 1) 420 ÷ (–15) = – 28 **2)** (–1300) × 2 = – 2600
3) 15 × (–15) = – 225
4) 112 + 75 + (–112) = [112 + (–112)] + 75
= zero + 75 = 75
5) (–144) ÷ 12 = – 12
6) (zero × 7) ÷ (–12) = zero ÷ (–12) = zero

5. Left to the student.

Worksheet 5

1. a) 17 **b)** $(-2)^{9-8} = (-2)^1 = -2$
c) $(-6)^2 = 36$ **d)** $\mathbb{Z}^*$ or $\mathbb{Z} - \{0\}$
e) $\mathbb{Z}^-$ **f)** $\mathbb{Z}^-$

2. a) = **b)** > **c)** =
d) > **e)** = **f)** <

3. a) 1 000 000, $(10)^5$, $(100)^2$, $(-1)^7$ and $(-10)^3$
b) 1) $-(3)^2 = -9$ **2)** $\frac{(-8)^{7+3}}{(-8)^9} = -8$

4. a) Not closure in addition and subtraction
because – 3 + 3 = zero ∉ X, 7 + (–1) = 6 ∉ X
7 – 3 = 4 ∉ X, –3 –3 = –6 ∉ X
b) The decrease in temperature = 32° – 18° = 14°

5. Left to the student.

Worksheet 6

1. a) 16,19 **b)** –6, –3 **c)** –10 , –12
d) 0, –4 **e)** $\frac{5}{3}$, 2

2. a) $x^2 + y$ **b)** –15 **c)** –4
d) > **e)** –2

3. Left to the student.

4. Left to the student.

5. 90, 87 , 84 , 81 , 78 , 75 , 72 , 69
He needs 7 months to reach 69 kg.

Test 1 on Unit 1

Left to the student.

Test 2 on Unit 1

Left to the student.

Worksheets on Unit 2

Worksheet 7

1. a) 3 **b)** 16 **c)** {2}
d) 1 **e)** $2x + 3 = 7$

2. a) 243,729 **b)** 2 (2)(3) = 12
c) {0, 1, 2} **d)** second

3. a) 1) 6 × ((–2) + (–7)) = 6 × (–9) = –54
2) (–25) + 39 + 25 = (–25) + (25) + 39
= 0 + 39 = 39
b) 4 × (–16) × 25 = 4 × 25 × (–16)
= 100 × (–16) = –1600

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4. 1) $-4 \notin$ S.S. , $-2 \notin$ S.S. , $0 \notin$ the S.S.
$2 \in$ S.S. because $2 \times 2 + 1 = 5$,
then the S.S. = {2}

2) $-4 \notin$ S.S. , $-2 \notin$ S.S. , $0 \in$ the S.S.
because $2 \times 0 + 5 \geq 3$, $2 \in$ the S.S.
because $2 \times 2 + 5 \geq 3$ then S.S. = {0, 2}

3) , 4) are left to the student.

5. a) $-18 , -16 , -14$ **b)** $\frac{5}{3} , 2 , \frac{7}{3}$
c) 125 , 216 , 343 **d)** 16 , 25 , 36

Worksheet 8

1. a) first **b)** 12 **c)** $\varnothing$
d) {3 , 4} **e)** – 4

2. a) $4x - 3x = 8 + 2$
$x = 10$ the S.S. = {10}
b) $3x - x = -13 + 2$ $2x = -11$
$x = \frac{-11}{2} \notin Z$ the S.S. = $\varnothing$
c) $2x = -10$ $x = -5$ the S.S. = {–5}

3. a) $3m = 6 - 12$ $3m = -6$ $m = -2 \notin N$
in N the S.S. = $\varnothing$ in Z the S.S. = {–2}
b) $12 + 5x = 27$
$12 + 5x - 12 = 27 - 12$
$5x = 15$ $x = \frac{15}{5} = 3$
In N ⟶ the S.S. = {3}
In Z ⟶ the S.S. = {3}
c) $\frac{3}{5}x = -6$ $\frac{5}{3} \times \frac{3}{5}x = \frac{5}{3}x - 6$
$x = -10$
∴ in N the S.S. = $\varnothing$
∴ in Z the S.S. = {–10}
d) $4x - 3x = -8 + 6$ $x = -2$
∴ in N the S.S. = $\varnothing$
∴ in Z the S.S. = {–2}

4. a) $2(-3) + 5 = -1 \neq 2$
$2(-2) + 5 = 1 \neq 2$ $2(-1) + 5 = 3 > 2$
$2(0) + 5 = 5 > 2$ $2(1) + 5 = 7 > 2$
the S.S. = {–1, 0, 1}
b) Let the number be x
$x + 3x = 64$ $4x = 64$
$x = \frac{64}{4} = 16$ Then the number is 16.

5. Left to the student.

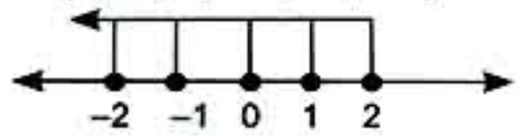
Worksheet 9

1. a) > **b)** 6 **c)** >
d) –6 **e)** Z^+

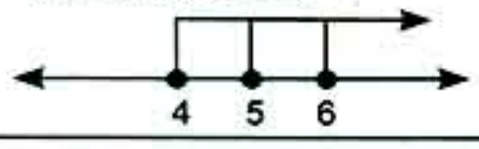
2. a) 5 **b)** $y < 1$ **c)** {–2 , –1, 0}
d) 3 or –3 **e)** 10

3. 1) $2x = -6$ $x = -3$ the S.S. = {–3}
2) $3x = 9$ $x = 3$ the S.S. = {3}

4. 1) $3x + 4 \leq 10$ $3x \leq 6$ $x \leq 2$
the S.S. = {2, 1, 0, –1, –2, ...}



2) $x - 1 > 2$ $x > 3$
the S.S. = {4, 5, 6, ...}



5. 1) $2(0) - 7 = -7 \neq -1$
$2(1) - 7 = -5 \neq -1$ $2(2) - 7 = -3 \neq -1$
$2(3) - 7 = -1$ the S.S. = {3}
2) $x + 4 > 5$ ∴ $x > 1$ the S.S. = {2, 3}

Test 1 on Unit 2

Left to the student.

Test 2 on Unit 2

Left to the student.

Worksheets on Unit 3

Worksheet 10

1. a) A (2, 2), B (2, –2), C (–4 , –2)
b) 6 units **c)** 4 units **d)** right-angled Δ

2. a) A (2 , 4) , B (5 , 0) , C (2 , –4) , D (–1 , 0)
b) AC = 8 length units **c)** BD = 6 length units
d) The s. area of ABCD = $\frac{1}{2} \times AC \times BD$
$= \frac{1}{2} \times 8 \times 6 = 24$ units sq.

3. a) $3x - x + 2 = x - x + 18$
$2x + 2 = 18$
$2x + 2 - 2 = 18 - 2$, $\frac{2x}{2} = \frac{16}{2}$
$x = 8$ the S.S. = {8}

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b) 112 $\big((17 + (-17)\big)$ distributive property
= 112 × zero "additive inverse prop." = zero

4. a) $x - 2y + 4 = 8 - 2(-2) + 4 = 8 + 4 + 4 = 16$

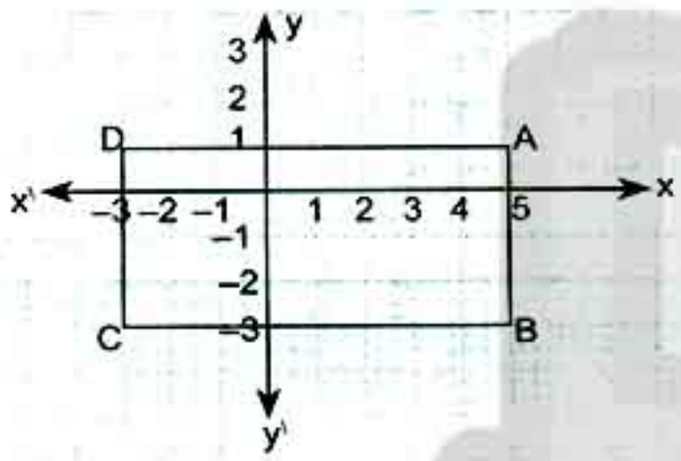
b) Ascending order is:
-30, -3×3, zero, 3 and $|-30|$

c) $2x - 5 + 5 \leq 7 + 5$
by adding (5) to both sides

$\frac{2x}{2} \leq \frac{12}{2}$ by dividing by 2

$x \leq 6$ the S.S. = {6, 5, 4.....}

5.



1) Length of $\overline{AB}$ = 4 length units
Length of $\overline{AD}$ = 8 length units

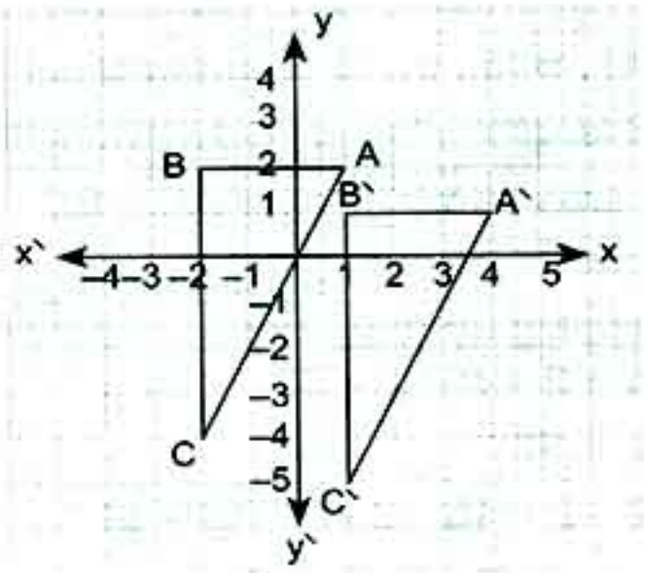
2) The perimeter of the shape = 2 (length + width)
= 2 (4 + 8) = 24 length units
Area of the shape = length × width
= 4 × 8
= 32 square units

Worksheet 11

1. a) (4,3) **b)** 5 **c)** (1 , 4)
d) {0} **e)** (–2, 4)

2. a) (1, 4) **b)** first **c)** (5, 2)
d) $\mathbb{Z}^-$ **e)** $\varnothing$

3.



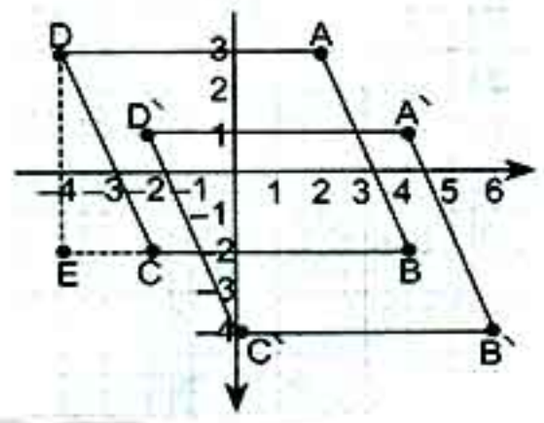
4. a) 1) Length of $\overline{AD}$ = |– 4 – 2| = |– 6|
= 6 length units

Length of $\overline{DE}$ = |– 2 – 3| = |– 5|
= 5 length units

Length of $\overline{BC}$ = |– 2 – 4| = |– 6|
= 6 length units

b) Area of the shape ABCD = BC × height
= 6 × 5 = 30 square units

Area of Δ DEC = $\frac{1}{2}$ CE × DE
= $\frac{1}{2}$ × 2 × 5 = 5 square units



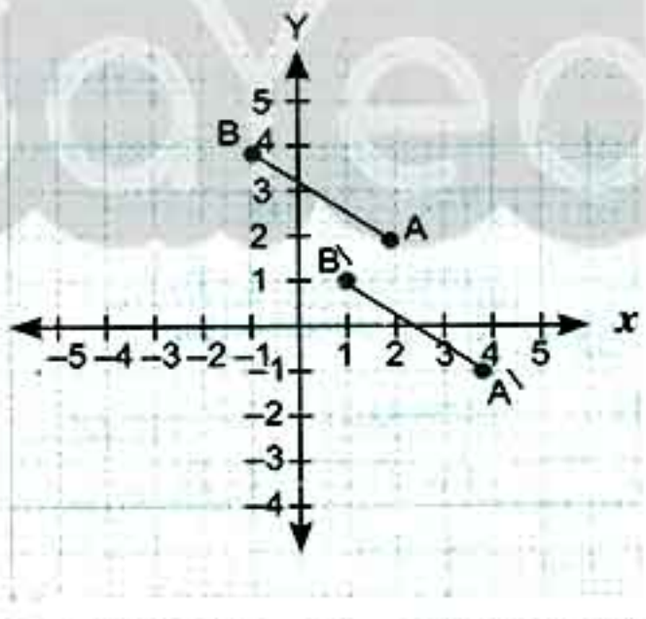
c) The image of the figure ABCD is A`B`C`D` as shown in the graph.

5. a) $\frac{(-3)^7}{(-3)^3} = (-3)^4 = 81$ **b) Left to the student.**

Worksheet 12

1. a) $9\pi = 28.3$ **b)** $25\pi = 78.5$
c) $64\pi = = 200.96$

2. a)



b) Radius = diameter ÷ 2 , circumference = $d\pi$
= 28 ÷ 2 = 14 cm

Circumference = $\overset{d}{2\pi r} = 2 \times \frac{22}{7} \times 14 \simeq 88$ cm

Area of the circle = πr^2
= $\frac{22}{7} \times (14)^2 \simeq 616$ cm^2

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3. a) Area = πr^2

$7546 = \frac{22}{7} r^2$ $\quad r^2 = 7546 \div \frac{22}{7}$

$r^2 = 2401$ $\quad r \simeq 49$ cm.

b) 1) Area of the square = $7 \times 7 = 49$ cm^2

Area of the circle = $\frac{22}{7} \times (3.5)^2 \simeq 38.5$ cm^2

Area of the shaded part = $49 - 38.5 = 10.5$ cm^2

2) Left to the student.

4. a) $x = 5$ b) $x = 11$

c) $x \in \{-3, -2, -1, ...\}$ d) $x \in \{3, 2, 1, ...\}$

5. Left to the student.

Worksheet 13

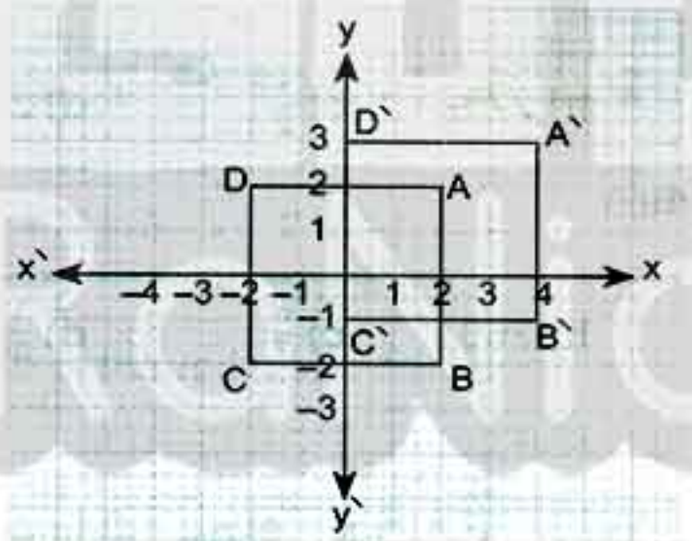
1. a) (0, 3) b) 4 c) 40

d) 314 e) 54

2. a) 25 b) 9 c) 10

d) (1, 5) e) 4

3.



1) square 2) 16 cm^2

4. a) The lateral area = $6 \times 6 \times 4 = 144$ cm^2

b) Left to the student.

5. Left to the student.

Test 1 on Unit 3

Left to the student.

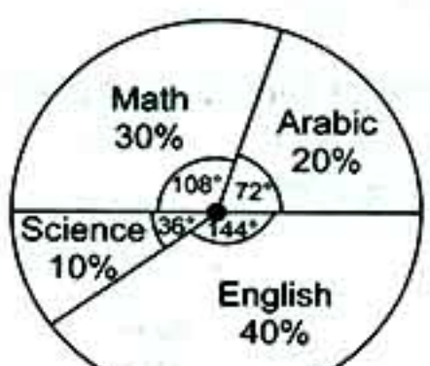
Test 2 on Unit 3

Left to the student.

Worksheets on Unit 4

Worksheet 14

1.



2. a) 133.2° b) (5, –6)

c) 78.5 cm^2 d) 42

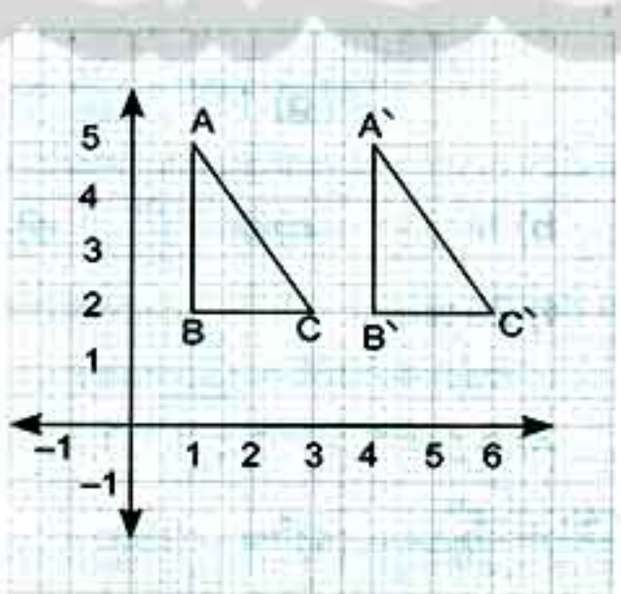
3. a) $2x + 1 - 1 = 8 - 1$

$\frac{2x}{2} = \frac{7}{2}$ $\quad x = \frac{7}{2} \notin Z$

then S.S. = $\varnothing$

b) $-1 \times (-2)^4 = -1 \times 16 = -16$

4. a)



b) $35 + (-35) + (-8) + 12$ commutative

$= (35 + (-35)) + ((-8) + 12)$ associative

zero + 4 = 4 (additive identity element)

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5. 1) Transportation = 100% – (25% + 30% + 20%)

= 25%

2) The measure of the central angle of rent

$= \frac{25}{100} \times 360° = 90°$

The measure of the central angle of food

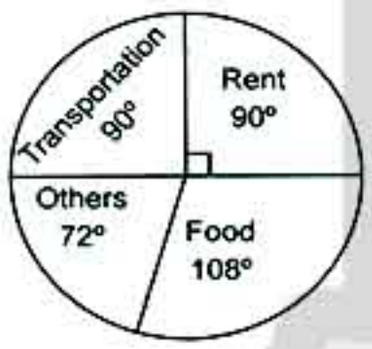
$= \frac{30}{100} \times 360° = 108°$

The measure of the central angle of transportation

$= \frac{25}{100} \times 360° = 90°$

The measure of the central angle of others

$= \frac{20}{100} \times 360° = 72°$



Worksheet 15

1. a) Sample space

b) It is an experiment in which we can determine all its possible outcomes before carrying it out, but we can't predict which of these outcomes will occur.

c) {22, 23, 32, 33} **d)** (–5 , –1)

e) { (T , H) , (H , T) , (H , H) , (T , T) }

f) 90° **g)** 1

2. a) –5 **b)** ℕ **c)** 8 **d)** 6

e) 60° **f)** 25 π

3. 1) 9 **2)** 8 × 1 ÷ 8 = 8 ÷ 8 = 1

3) $\frac{-(4)^{11} \times 45}{4^{12}} = \frac{-4^{16}}{4^{12}} = -(4)^4 = -256$

4. a) S = {1, 2, 3, 4, 5, 6}

b) Area = $7 \times 14 + \frac{22}{7} \times \left(\frac{7}{2}\right)^2 = 136.5\ cm^2$

Perimeter = $2 \times 14 + 2 \times \frac{22}{7} \times \left(\frac{7}{2}\right) = 50$ cm

5. The measure of the central angle of the first sector

$= \frac{15}{100} \times 360° = 54°$

The measure of the central angle of the second sector

$= \frac{10}{100} \times 360° = 36°$

The measure of the central angle of the third sector

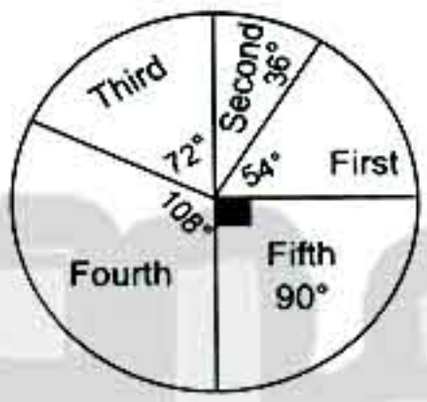
$= \frac{20}{100} \times 360° = 72°$

The measure of the central angle of the fourth sector

$= \frac{30}{100} \times 360° = 108°$

The measure of the central angle of the fifth sector

$= \frac{25}{100} \times 360° = 90°$



Worksheet 16

1. a) 1 **b)** 27% **c)** $\frac{1}{2}$ **d)** zero

e) a certain

2. a) $\frac{14}{17}$ **b)** 360 **c)** $\frac{3}{7}$ **d)** $\frac{15}{40} = \frac{3}{8}$

e) $\frac{1}{2}$

3. (1) {33, 83} **(2)** {33, 88}

4) , 5) Left to the student.

Test 1 on Unit 4

Left to the student.

Test 2 on Unit 4

Left to the student.

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Answers of Model Tests from the School Book

Model Test 1

1. **1)** 0 **2)** (–3 , 0) **3)** ⊂ **4)** 0

2. **1)** ∈ **2)** –4 **3)** 6 **4)** $\frac{8}{16} = \frac{1}{2}$

3. **a)** $-17^{\cdot}$ **b)** $x \in \{5, 6, 7, ...\}$

4. **a)** Area of one face = $10 \times 7 = 70\ cm^2$

The lateral surface = $70 \times 4 = 280\ cm^2$

b) The circumference = $2\pi r = 88$

$\therefore 2 \times \frac{22}{7} \times r = 88 \Rightarrow r = 88 \times \frac{7}{44} = 14$ cm

The area of the circle = $(14)^2 \times \frac{22}{7} = 616\ cm^2$

5. **a)** $3x + 9 = 3 \Rightarrow 3x = 3 - 9 = -6$ $\therefore x = -2$

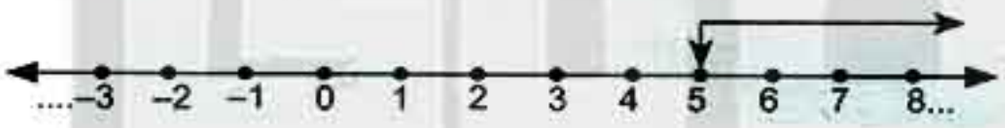
b) Left to the student.

Model Test 2

1. **1)** Z^- **2)** 2 r **3)** $\frac{1}{6}$ **4)** –1

2. **1)** $\frac{2^8}{2^2} = 2^6$ **2)** ⊂ **3)** 5 **4)** $\frac{1}{3}$

3. **1)** –32 **2)** {5 , 6 , 7 , 8 , ...}



4. **a)** $2x + 9 = 5$ $2x = 5 - 9$

$x = -2$ Solution set = {–2}

b) Area of the rectangle ABCD = L × W = 8 × 7

$= 56\ cm^2$

Area of the circle = $\pi r^2 = \frac{22}{7} \times \left(\frac{7}{2}\right)^2 = 38.5\ cm^2$

Area of the shaded part = $56 - 38.5 = 17.5\ cm^2$

5. Left to the student.

Model 3

1. **1)** 3 **2)** zero **3)** 1 **4)** 40

2. **1)** 27 **2)** r^2 **3)** N **4)** $\frac{1}{2}$

3. **1)** ✓ **2)** ✗ **3)** ✗ **4)** ✓

4. **1)** 360° **2)** ∈ **3)** {0 , 1 , 2} **4)** (4,4)

5. **a)** The total area = $6 \times 4 \times 4 = 96\ cm^2$

The lateral area = $4 \times 4 \times 4 = 64\ cm^2$

b) $\frac{2^3 \times 2^4}{2^5} = \frac{2^{3+4}}{2^5} = \frac{2^7}{2^5} = 2^{7-5} = 2^2 = 4$

Answers of some School Examinations

(1) Cairo – El-Sahel Educational Zone

1. **1)** ∅ **2)** $-(3)^2$ **3)** second **4)** $\frac{1}{6}$

5) –24 **6)** 4 **7)** 25 **8)** 1

9) (–2 , –7) **10)** 2^5 **11)** 0.2 **12)** {4}

2. **13)** 54 cm^2 **14)** Z^- ∪ {0}

15) (–1 , 2) **16)** 18

17) 360 **18)** 50 **19)** $x < -3$ **20)** 10

3. **21)** $3x - 7 = 11$, $x \in Z$

$3x = 11 + 7 = 18$

$\frac{3x}{3} = \frac{18}{3} \Rightarrow x = 6$

S.S. = {6}

22) The area of a circle = πr^2

$= \frac{22}{7} \times 7 \times 7 = 154\ cm^2$

The area of each sector = $154 \div 7 = 22\ cm^2$

23) $x - 2 \leq 3$ where $x \in N$

$x \leq 3 + 2 \Rightarrow x \leq 5$

S.S. = {5 , 4 , 3 , 2 , 1 , 0}

24) The side length of the cube = $28 \div 4 = 7$ cm.

a) L.S.A. = perimeter of base x height

$= 28 \times 7 = 196\ cm^2$

b) T.S.A. = $6 \times 7 \times 7 = 294\ cm^2$

25) The measure of the angle which represents

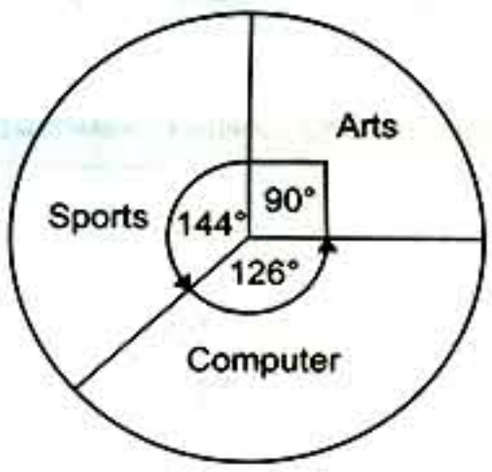
arts = $\frac{25}{100} \times 360° = 90°$

The measure of the angle which represents

sports = $\frac{40}{100} \times 360° = 144°$

The measure of the angle which represents

computer = $\frac{35}{100} \times 360° = 126°$



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(2) Cairo - Helioplis Directorate - St. Joseph's School

1. **1)** $\mathbb{N}$ **2)** 3^2 **3)** $(-3 , 0)$ **4)** $120°$
5) -1 **6)** $>$ **7)** $\frac{1}{6}$ **8)** -1
9) 400 **10)** $(-1)^7$ **11)** $\in$ **12)** $2 \pi r$

2. **13)** height **14)** -1 **15)** zero
16) 3 **17)** 6 **18)** commutative
19) $\{-1 , 0 , 1\}$ **20)** $(-3 , 0)$

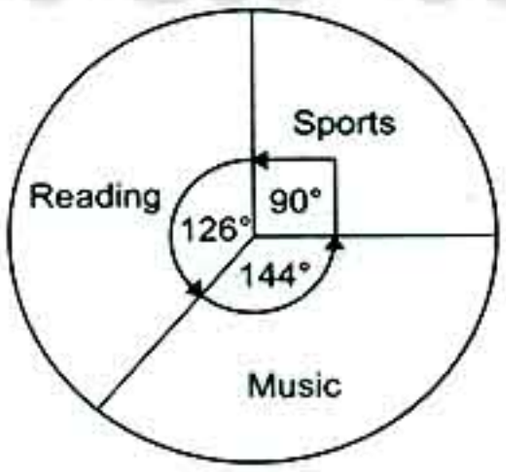
3. **21)** $2x + 11 = 3 \Rightarrow 2x = 3 - 11$
Then $\frac{2x}{2} = \frac{-8}{2}$ so $x = -4$
The S.S. $= \{-4\}$

22) $37 \times 17 + 37 \times (-17)$
$= 37 \times [17 + (-17)] = 37 \times 0 = 0$

23) Area of carpet $= \pi r^2 = \frac{22}{7} \times (3.5)^2 = 38.5 \text{ m}^2$
The price of the carpet $= 38.5 \times 100$
$= 3850$ pounds

24) The total area of the cuboid
= lateral area + area of two bases
$= (3 + 2) \times 2 \times 6 + 2 \times 3 \times 2$
$= 60 + 12 = 72 \text{ cm}^2$

25) The measure of the angle of the sector that represents sports $= \frac{25}{100} \times 360° = 90°$
The measure of the angle of the sector that represents reading $= \frac{35}{100} \times 360° = 126°$
The measure of the angle of the sector that represents music $= \frac{40}{100} \times 360° = 144°$



(3) Cairo - Rod El-Farag Educational Zone

1. **1)** $\notin$ **2)** 5 **3)** 16 **4)** 9
5) zero **6)** -3 **7)** 54 **8)** zero
9) 4 **10)** 9^2 **11)** third **12)** $90°$

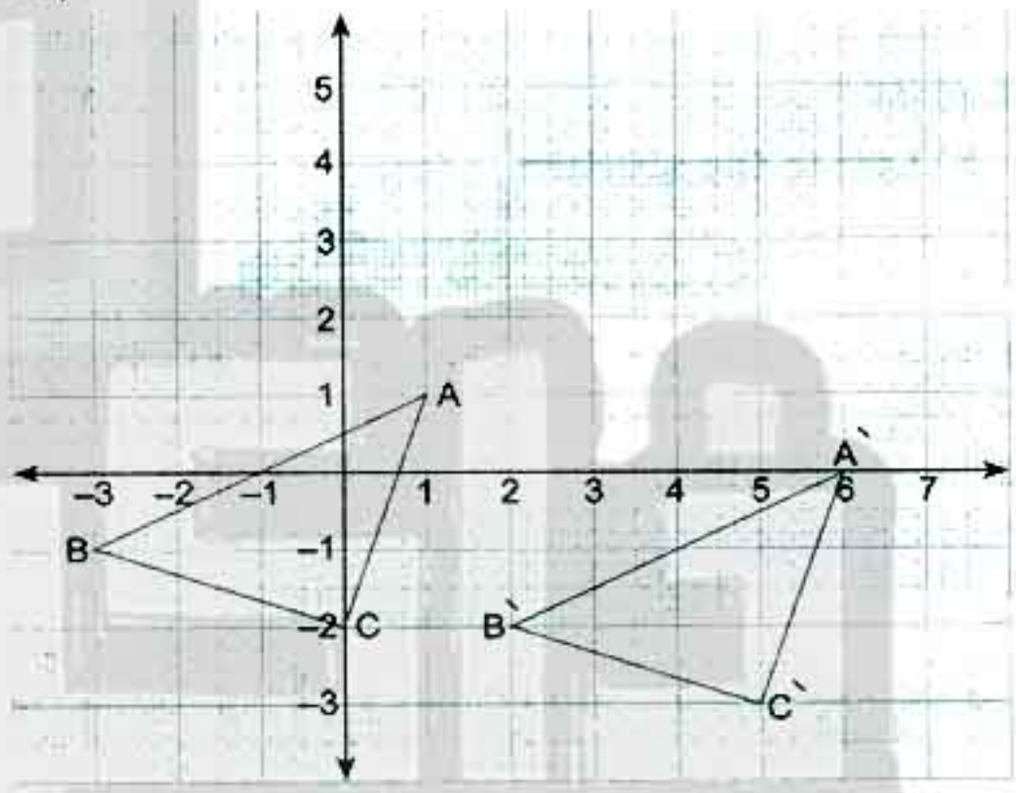
2. **13)** $(0 , 1)$ **14)** $\varnothing$ **15)** $\frac{1}{6}$ **16)** height
17) $(-2)^2$ **18)** 64 **19)** -8 **20)** 6

3. **21)** $32 \times (117 - 17) = 32 \times 100 = 3200$

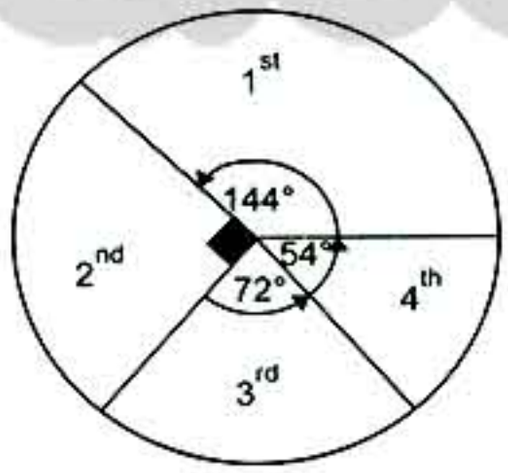
22) $2x - 2 \geq 4$ $2x \geq 4 + 2$
$2x \geq 6$ then $x \geq \frac{6}{2}$
$x \geq 3$
then the S.S. $= \{3 , 4 , 5 , ...\}$

23) The lateral area = perimeter of base × height
$= 10 \times 4 \times 6 = 240$ cm.
the total area = 2 area of base + area lateral area
$2 \times 10 \times 10 + 240 = 440 \text{ cm}^2$

24)



25) $1^{st} = \frac{40}{100} \times 360 = 144°$ $2^{nd} = \frac{25}{100} \times 360 = 90°$
$3^{rd} = \frac{20}{100} \times 360 = 72°$ $4^{th} = \frac{15}{100} \times 360 = 54°$



(4) Cairo - El Zeitoun Directorate - Special Republic School

1. **1)** $<$ **2)** $\notin$ **3)** 0 **4)** 1
5) $\{-2\}$ **6)** -3 **7)** $\in$ **8)** $(6 , -3)$
9) 25 **10)** L. area $= 10 \times 4 = 40$
11) 0.3 **12)** 0

هذا العمل خاص بموقع ذاكرولى التعليمى ولا يسمح بتداوله على مواقع أخرى
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2. 13) {0} **14)** Z^+ **15)** 14 cm **16)** $2^4 = 16$
17) 10 cm **18)** 5 **19)** 1 **20)** 54 cm^2

3. 21) $3 \times [(-2) + 5] = 3 \times 3 = 9$

22) $3x = -15$

$x = -5$ S.S. = ∅

23) Lateral area = base P × h = (12 × 4) × 12 = 576 cm^2

T.S. area = 576 + (2 × 12 × 12) = 864 cm^2

24) Shaded part = area of square – area of circle

$= (14 \times 14) - (\frac{22}{7} \times 7 \times 7)$

$196 - 154 = 42\ cm^2$

25) Cultural activities $= \frac{25}{100} \times 360 = 90°$

Sport $= \frac{50}{100} \times 360 = 180°$

Social activities $= \frac{15}{100} \times 360 = 54°$

Arts $= \frac{10}{100} \times 360 = 36°$



1. 1) 0.5 **2)** 54 **3)** ∅ **4)** 30°
5) 1 **6)** $\frac{1}{2}$ **7)** 6 **8)** 1
9) ∈ **10)** (–3 , 5) **11)** 314 **12)** 20
13) 5^2 **14)** ⊂

2. 15) commutative **16)** 0 **17)** 5
18) 256 **19)** second **20)** –2 **21)** 1
22) $\frac{2}{7}$

3. 23) a) {–5}

b) $3x \leq 9$

$x \leq 3$ {3 , 2 , 1 , 0 , –1, ...}

24) Lateral area = base perimeter × height

$= 20 \times 8 = 160\ cm^2$

Total S. area = 2 × base area + L. area

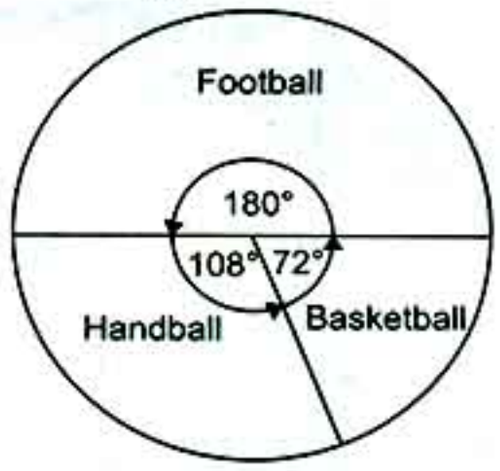
$= (24 \times 2) + 160$

$= 208\ cm^2$

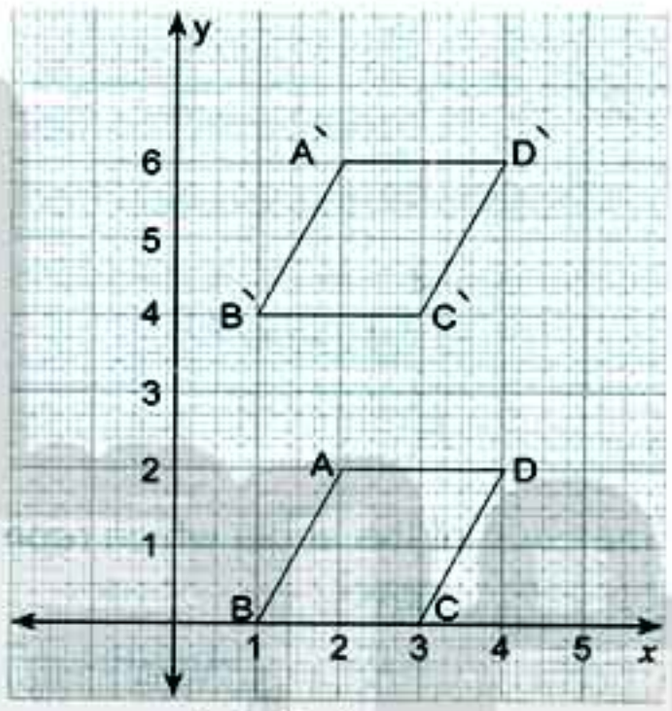
25) Football $= \frac{50}{100} \times 360 = 180°$

Handball $= \frac{30}{100} \times 360 = 108°$

Basketball $= \frac{20}{100} \times 360 = 72°$



26)



The figure A`B`C`D` is the image of ABCD
ABCD is a parallelogram.

1. 1) –1 **2)** ∉ **3)** 2 **4)** (–3 , 0)
5) Z **6)** 216 **7)** $\frac{1}{6}$ **8)** 314
9) 3 **10)** 14 **11)** 10 **12)** 180°

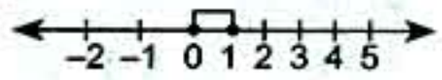
2. 13) zero **14)** ∅ **15)** 3200 **16)** 96
17) the centre **18)** {3 , 2 , 1 , 0}
19) {–3} **20)** 2(L + w) × h

3. 21) a) $(-5) \times [2] = -10$ **b)** $7^{4+5-7} = 7^2 = 49$

22) $2x - 3 < 1$ $x \in N$

$2x < 1 + 3$ $\frac{2x}{2} < \frac{4}{2} \Longrightarrow x < 2$

S.S. = {0 , 1}



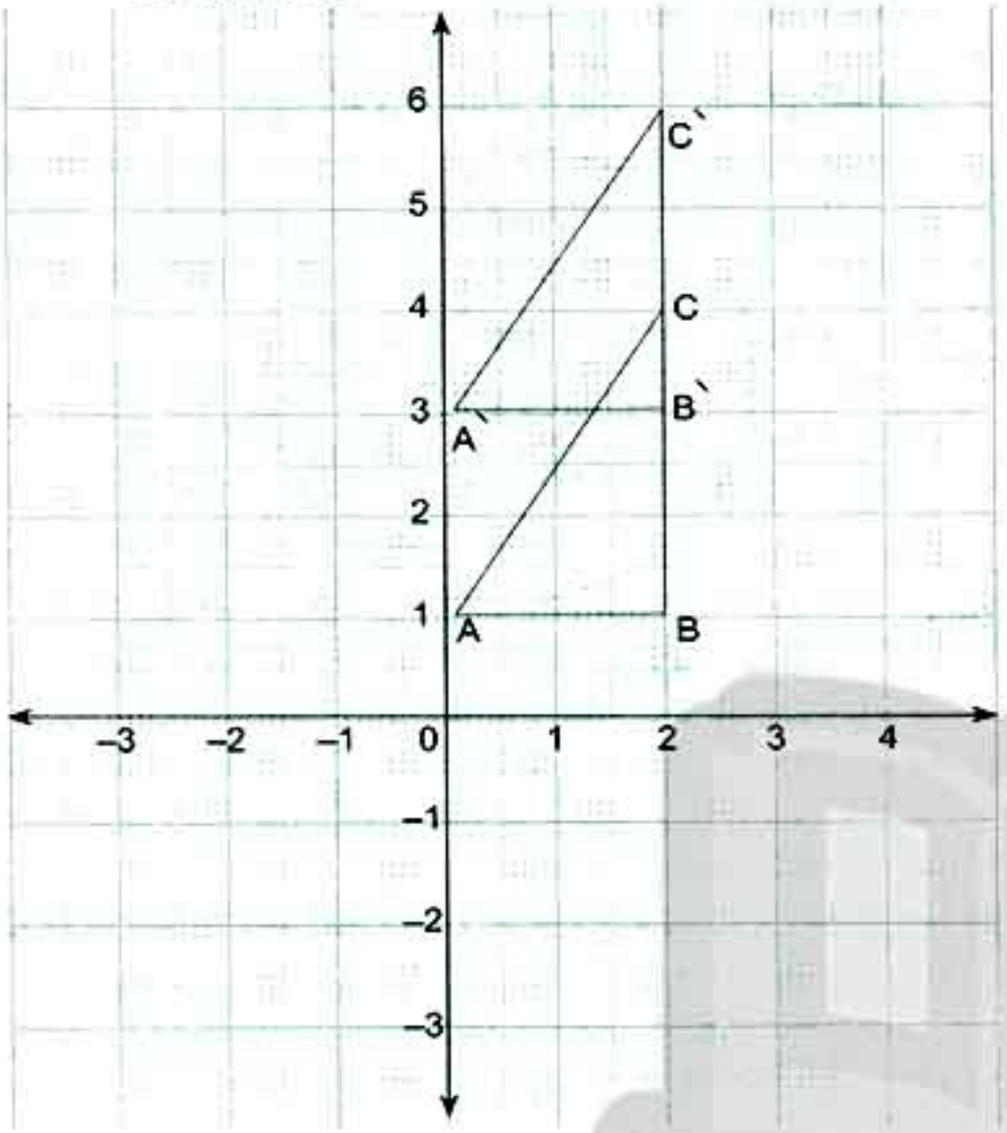
23) $x + 4 > 5$ $x \in Z$

$x > 5 - 4 \Longrightarrow x > 1$ S.S. = {2 , 3 , ...}

24) a) The length of $\overline{BC}$ = 3 units length.

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b) The image of Δ ABC by translation (0 , 2) is Δ A`B`C`

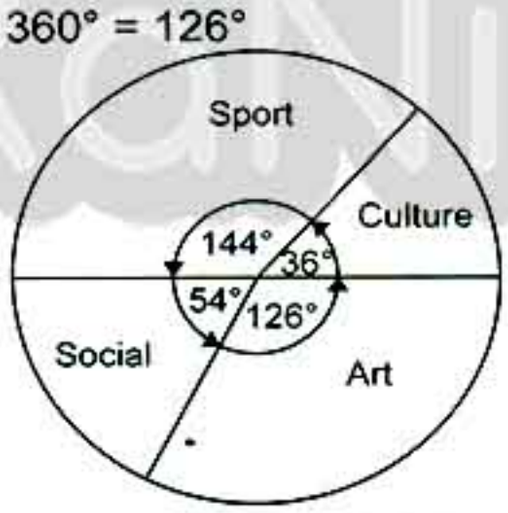


25) The measure of the angle which represents culture = $\frac{10}{100} \times 360° = 36°$

The measure of the angle which represents sport = $\frac{40}{100} \times 360° = 144°$

The measure of the angle which represents social = $\frac{15}{100} \times 360° = 54°$

The measure of the angle which represents art = $\frac{35}{100} \times 360° = 126°$

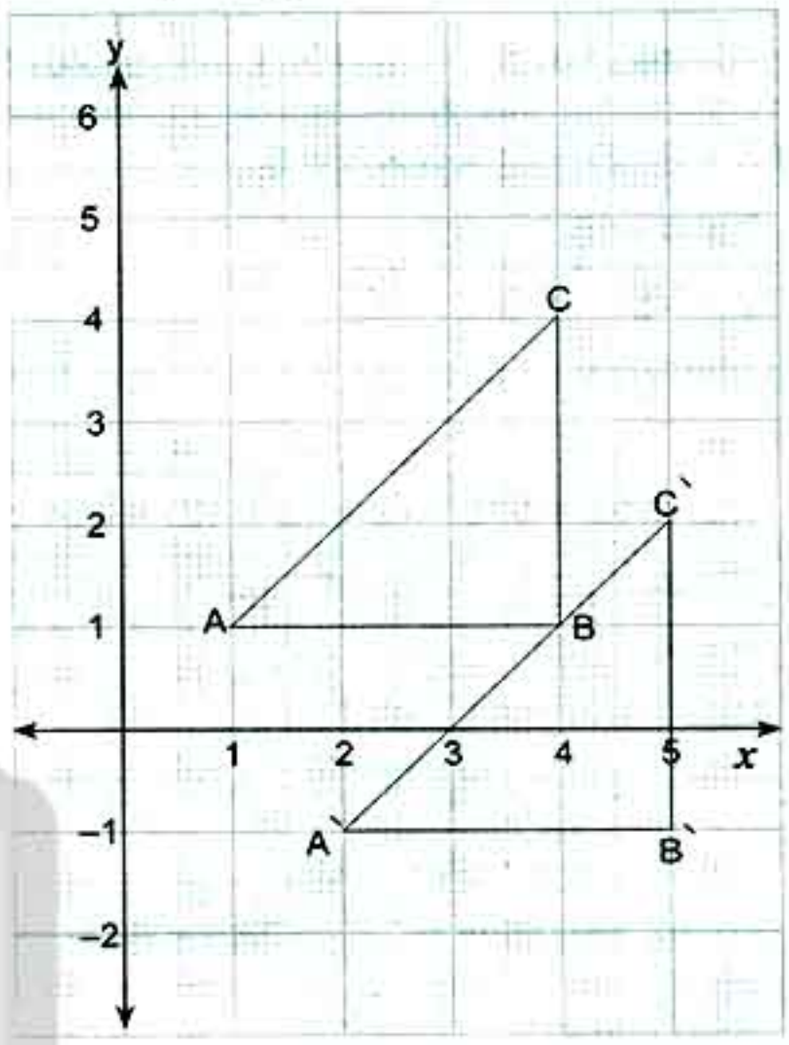


1. **1)** ∅ **2)** –1 **3)** –2 **4)** 3rd
5) – 4 **6)** (0 , 0) **7)** 1 **8)** zero
9) $\frac{1}{2}$ **10)** 6 **11)** 120° **12)** 54

2. 13) 18 14) 7 15) 6
16) L.S.A. = (3 + 4) × 2 × 5 = 70 **17)** 7
18) zero **19)** 14 **20)** 4

3. 21) $7^{5 \cdot 1 - 4} = 7^2 = 49$

22)



23) The area of the figure = $\frac{1}{2} \times \frac{22}{7} \times (7)^2 = 77\ cm^2$

24) $2x + 9 = 13$

a) $2x = 13 - 9$

$\frac{2x}{2} = \frac{4}{2}$ then $x = 2$ The S.S. = {2}

b) $x - 1 < 2$ $x < 2 + 1$

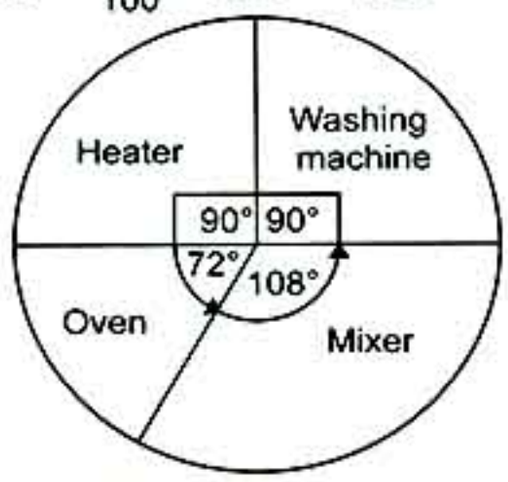
then $x < 3$ S.S. in N = {2 , 1 , 0}

25) The measure of the angle of the sector which represents washing machine = $\frac{25}{100} \times 360° = 90°$

The measure of the angle which represents the heater = $\frac{25}{100} \times 360° = 90°$

The measure of the angle which represents the oven = $\frac{20}{100} \times 360° = 72°$

The measure of the angle which represents the mixer = $\frac{30}{100} \times 360° = 108°$



1. **1)** $\bar{Z}$ **2)** > **3)** The side length
4) 314 **5)** –2 **6)** 10 **7)** zero
8) –1 **9)** (–3 , 0) **10)** 0 **11)** 3

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12) third **13)** 3.6 **14)** $\frac{1}{3}$

2. 15) $2 \times (L + W)$ **16)** $\varnothing$ **17)** 1
18) zero **19)** 4 **20)** second

3. 21) $(-2)^{7*5-9} = (-2)^3 = -8$

22) $2x - 3 = -9$

$2x = -9 + 3$ $\frac{2x}{2} = \frac{-6}{2}$ then $x = -3$

23) $2x - 1 \leq 5$ s.s. = {–3}

$2x \leq 5 + 1$, then $\frac{2x}{2} \leq \frac{6}{2} \Rightarrow x \leq 3$

The S.S. = {3 , 2 , 1 , 0}

24) The circumference = $2\pi r = 88$

Then $\frac{2 \times 22}{7} r = 88$

$r = \frac{88 \times 7}{2 \times 22} = 14$ cm

The area of the circle = $\pi r^2 = \frac{22}{7} \times (14)^2 = 616$ cm^2

25) The area of two bases = 132 – 112 = 20 cm^2

Then the area of base = $\frac{20}{2} = 10$ cm^2

26) The angle of sector of the first

$= \frac{15}{100} \times 360° = 54°$

The measure of the angle of sector of the second

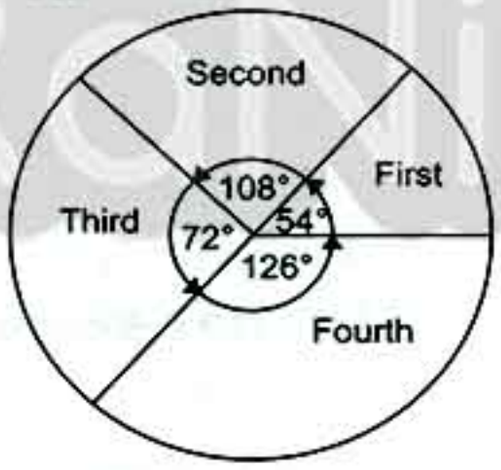
$= \frac{30}{100} \times 360° = 108°$

The measure of the angle of sector of the third

$= \frac{20}{100} \times 360° = 72°$

The measure of the angle of the fourth

$= \frac{35}{100} \times 360° = 126°$



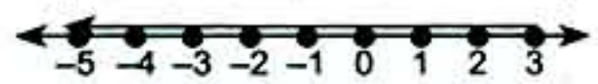
9 Alexandria - Educational Zone - Mathematics Inspection

1. 1) $x = 8$ **2)** $\frac{5}{6}$ **3)** 3000 **4)** 5

5) {–3} **6)** $\frac{r^2}{2}$ **7)** 3 **8)** (5 , –1)

2. 9) (–3)3 **10)** 12 or (–12) **11)** {2}
12) 3 : 2 **13)** $\in$ **14)** Z^- **15)** 0.77
16) – **17)** zero **18)** 154 cm^2 **19)** –20
20) 5

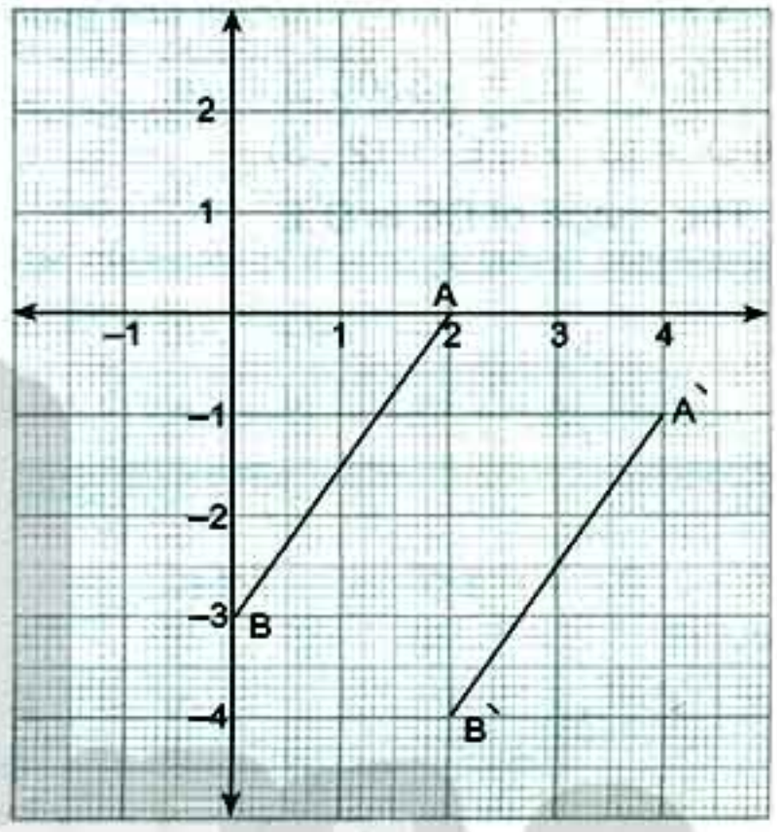
3. 21) S.S. = {2 , 3 , 1 , 0 , –1 , ...}



22) $-(a + b)^c = -(-2 - 3)^0 = -(-5)^0 = -1$

23) The area of one face = 468 ÷ 6 = 78 cm^2
The L.S.A. = 4 × 78 = 312 cm^2

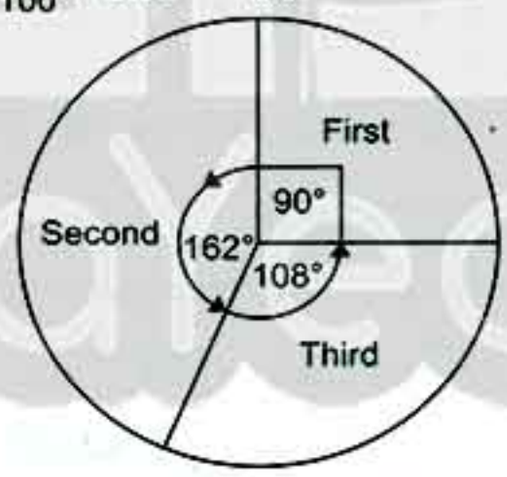
24) $\overline{A`} = (4 , -1)$, $B` = (2 , -4)$
$\overline{A`B`}$ is the image of $\overline{AB}$



25)

Farm	First	Second	Third
Percentage	25%	45%	30%

The measure of the angle that represents the first = $\frac{25}{100} \times 360° = 90°$



The measure of the angle that represents the second = $\frac{45}{100} \times 360° = 162°$

The measure of the angle that represents the third = $\frac{30}{100} \times 360° = 108°$

10 Alexandria - El Montazah Educational Zone - Maths Supervision

1. 1) zero **2)** (1 , –3) **3)** $\in$ **4)** $x \leq 2$
5) $\frac{1}{6}$ **6)** 49 π cm^2 **7)** zero **8)** –1
9) $\varnothing$ **10)** second **11)** 90° **12)** <

2. 13) 2 r **14)** 6 **15)** 4 **16)** 15
17) 400 **18)** $\frac{1}{2}$ **19)** {0} **20)** (–1 , 2)

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3. 21) $2x - 1 = -3$

$2x = -3 + 1 = -2$

$\frac{2x}{2} = \frac{-2}{2} \Rightarrow x = -1$

S.S. {–1}

22) The area of one face = 36 ÷ 4 = 9 cm^2

The T.S.A. = 9 × 6 = 54 cm^2

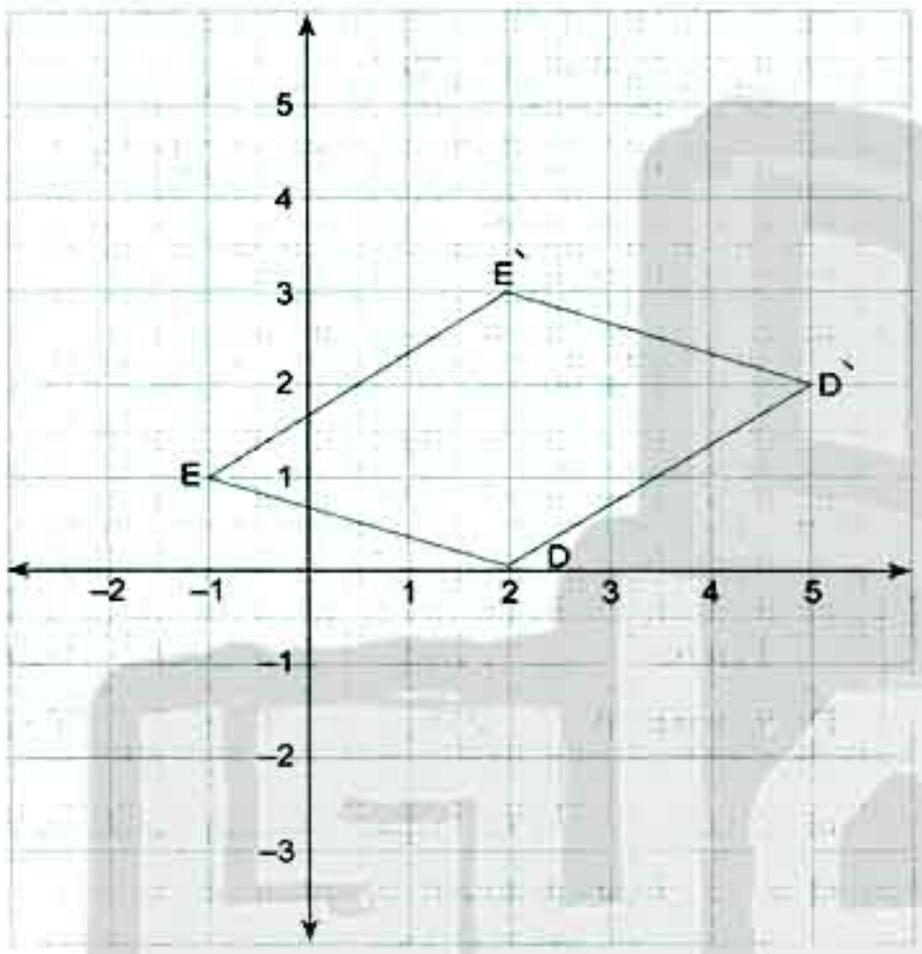
23) 4 × (–33) × 25

= (4 × 25) × (–33) commutative and associative

= 100 × (–33) = – 3300 closure

24) a) D` = (5 , 2) , E` = (2 , 3)

The image of $\overline{DE}$ is $\overline{D`E`}$



b) The name of the shape DD`EE` is a parallelogram.

25) The measure of the angle which represents

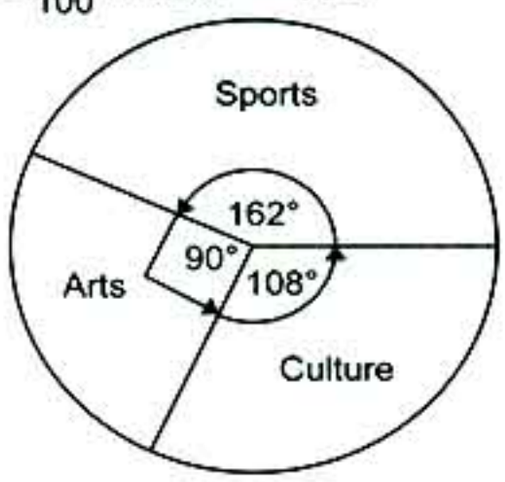
sports = $\frac{45}{100} \times 360° = 162°$

The measure of the angle which represents

arts = $\frac{25}{100} \times 360° = 90°$

The measure of the angle which represents

culture = $\frac{30}{100} \times 360° = 108°$



(11) Alexandria - East Educational Directorate - Maths Inspectorate

1. 1) $\mathbb{Z}^-$ **2)** $\subset$ **3)** –3 **4)** =

5) < **6)** 5 **7)** –1 **8)** 144

9) (–2 , –7) **10)** 4 **11)** 360° **12)** zero

2. 13) 12 **14)** 7 **15)** {2 , 1 , 0}

16) (3 , 5) **17)** 6 **18)** 150 **19)** 40

20) $\frac{1}{6}$

3. 21) The order is: –15 , –9 , |–9| , 16 , 17

22) $(-5)^{3+2-4} = (-5)^1 = -5$

23) The area of the circle = πr^2

$= \frac{11}{\cancel{7}} \frac{\cancel{22}}{\cancel{7}} \times \frac{\cancel{7}}{\cancel{2}} \times \frac{7}{2} = 38.5\ cm^2$

(12) Menofia - El-Sadat Directorate - Mathematics Supervision

1. 1) $x = 9$ **2)** (5 , –5) **3)** > **4)** 0.5

5) N **6)** 2 : 3 **7)** 10 **8)** $\notin$

9) 1 **10)** 90° **11)** 4 **12)** –2

2. 13) 3 **14)** 6 **15)** Second

16) zero **17)** 180° **18)** {3 , 2 , 1 , 0}

19) – 25 **20)** $\varnothing$

3. 21) $2^4 \times (-2)^{7-5-2}$

$2^4 \times (-2)^0 = 2^4 \times 1 = 16$

22) L.S.A. = perimeter of base × h

= 2 (16 + 7) × 9

= 46 × 9 = 414 cm^2

T.S.A. = L.S.A. + area of one base

= 414 + (16 × 7)

414 + 112 = 526 cm^2

23) Area of the shaded part

= area of circle – area of square

$= \pi r^2 - \frac{d^2}{2} = \frac{22}{7}(7)^2 - \frac{(14)^2}{2} = 154 - 98 = 56\ cm^2$

24) a) $x + 8 = 19$

$x = 19 - 8 = 11$ S.S. = {11}

b) $1 - 2x > 5$ $-2x > 5 - 1$

$\frac{-2x}{-2} > \frac{4}{-2}$

$x < -2$

S.S. = {–3, –4, ...}.

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25) The measure of the angle which represents sports $= \frac{40}{100} \times 360 = 144°$

The measure of the angle which represents social activities $= \frac{35}{100} \times 360° = 126°$

The measure of the angle which represents arts $= \frac{25}{100} \times 360° = 90°$



13 Gharbia - Educational Zone - Maths Inspectorate

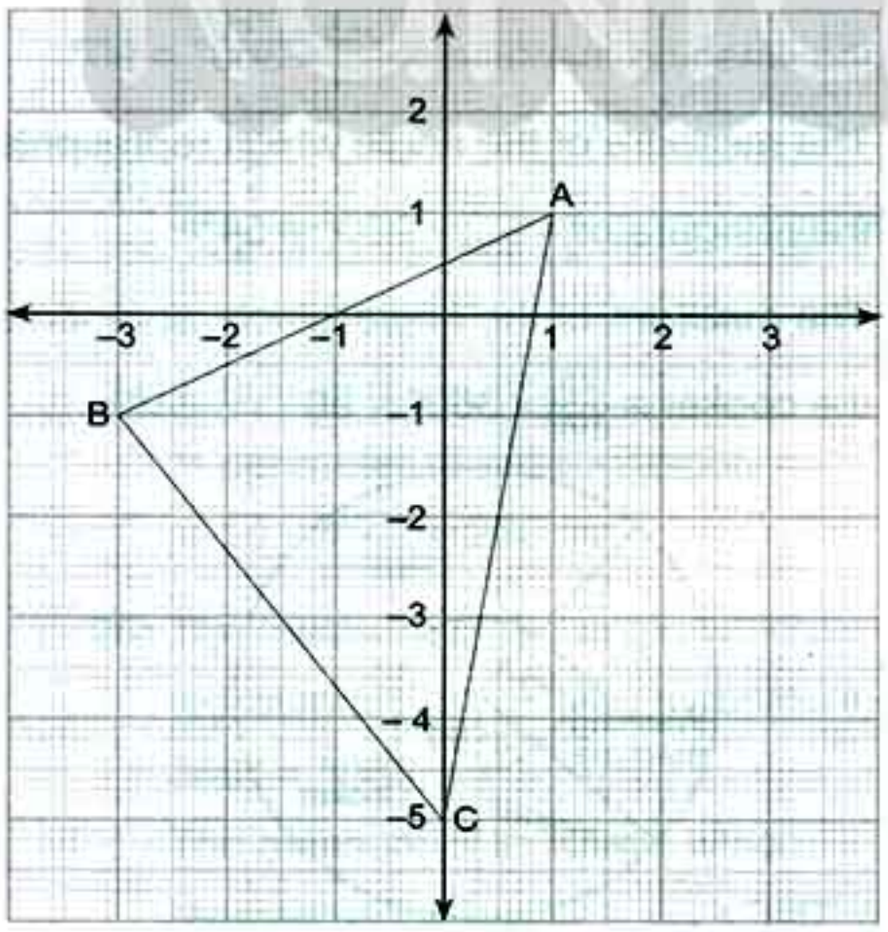
1. 1) $\mathbb{Z}^-$ **2)** third(3^{rd}) **3)** $(-5 , -1)$ **4)** $x + 1$
5) 2 **6)** 16π **7)** $\varnothing$ **8)** $\frac{3}{20}$
9) $|-5|$ **10)** 0.3 **11)** $\frac{1}{6}$ **12)** $\mathbb{Z}^+$

2. 13) 4 × the area of one face
14) 12 **15)** $(1 , 0)$ **16)** 314 **17)** -4
18) 160 **19)** 5 **20)** 16

3. 21) $8^{3+5-8} = 8^0 = 1$

22) The area of the shaded part $= 8 \times 7 - \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} = 56 - 38.5 = 17.5\ cm^2$

23)



24) 1) The probability of getting a number greater than 6 = zero

2) the probability of getting a prime number $= \frac{1}{2}$

25) The measure of the angle which represents the 1^{st} $= \frac{10}{100} \times 360° = 36°$

The measure of the angle which represents the 2^{nd} $= \frac{35}{100} \times 360° = 126°$

The measure of the angle which represents the 3^{rd} $= \frac{30}{100} \times 360° = 108°$

The measure of the angle which represents the 4^{th} $= \frac{25}{100} \times 360° = 90°$

The drawing is left to the student.

14 Kafr El-Sheikh - Mathematics Supervision

1. 1) 0 **2)** 0.5 **3)** $x > 7 - 5$
4) -45 **5)** $(2 , 2)$ **6)** -1 **7)** 484
8) -4 **9)** 1 **10)** $\subset$ **11)** third
12) 6

2. 13) zero 14) r^2 15) 216
16) -2 **17)** $\frac{8}{20} = \frac{2}{5}$ **18)** $(5 , -6)$
19) 20 **20)** height

3. 21) $63 \times (85 + 15) = 63 \times 100 = 6300$

22) $3x + 2 \leq 11$ $\quad x \in \mathbb{Z}$

$3x \leq 11 - 2$ $\quad \frac{3x}{3} \leq \frac{9}{3} \Rightarrow x \leq 3$

S.S. $= \{3 , 2 , 1 , 0 , -1 , -2 , ...\}$

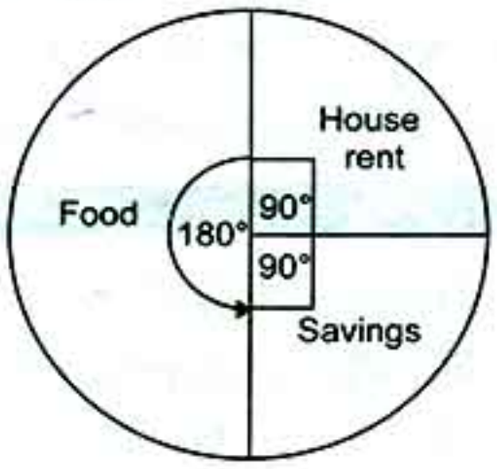
23) L.S.A. $= 4 \times 9 \times 20 = 720\ cm^2$

T.S.A. $= 720 + 2 \times 9 \times 9 = 720 + 162 = 882\ cm^2$

24) The measure of the angle that represents the rent of the house $= \frac{25}{100} \times 360° = 90°$

The measure of the angle that represents food $= \frac{50}{100} \times 360° = 180°$

The measure of the angle that represents savings $= \frac{25}{100} \times 360° = 90°$



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25) The area of the circle = πr^2

$= 3.14 \times 6 \times 6 = 113.04\ cm^2$

(15) Damietta - Directorate of Official Language Schools

1. 1) N **2)** third **3)** 16 **4)** (–2 , 3)
5) $\frac{1}{2}$ **6)** zero **7)** – 4 **8)** 256
9) 120 **10)** $\mathbb{Z}^-$ **11)** 1 **12)** {2}

2. 13) $\frac{(-2)^{7+5}}{2^{10}} = \frac{(-2)^{12}}{2^{10}} = 2^{12-10} = 2^2 = 4$

14) 10 **15)** 6 **16)** 8 **17)** $\frac{8}{16} = \frac{1}{2}$
18) 1 **19)** (–1 , 5) **20)** πr^2

3. 21) $3x - 2 \geq 4$

$3x \geq 6 \Rightarrow x \geq 2$

S.S. = {2 , 3 , 4 , ...}

22) 115 + 390 + (–115) = [115 + (–115)] + 390

Commutative and associative property

= 0 + 390 additive inverse = 390 closure

23) The total area of cube = $12 \times 12 \times 6 = 864\ cm^2$

24) The area of the circle

$= \pi r^2 = \frac{22}{7} \times 7 \times 7 = 154\ cm^2$

25) The measure of the angle which represents

excellent = $\frac{15}{100} \times 360° = 54°$

The measure of the angle which represents

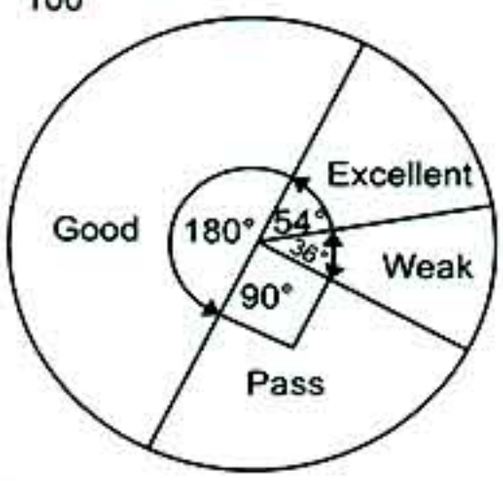
good = $\frac{50}{100} \times 360° = 180°$

The measure of the angle which represents

pass = $\frac{25}{100} \times 360° = 90°$

The measure of the angle which represents

weak = $\frac{10}{100} \times 360° = 36°$



(16) Sharkia - Directorate of Education - Mathematics Department

1. 1) zero **2)** 3 **3)** –3 **4)** $\frac{1}{6}$
5) 3^3 **6)** {–2} **7)** {–5 , –1} **8)** ∅
9) 360° **10)** –1 **11)** –6 **12)** 54

2. 13) $(-5) \times [7 + (-5)] = (-5) \times 2 = -10$

14) Second degree **15)** 16 **16)** 2
17) –1 **18)** –1 **19)** zero **20)** m – n

3. 21) $\frac{2^5 \times (-2)^3}{(-2) \times 2^4} = 2^{5-4} \times (-2)^{3-1} = 2 \times (-2)^2$

$= 2 \times 4 = 8$

22) 1) The lateral area of the cuboid

$= 2\ (6 + 4) \times 8 = 2 \times 10 \times 8 = 160\ cm^2$

2) The total surface area

= L.S.A. + area of two bases

$= 160 + 2 \times 6 \times 4 = 160 + 48 = 208\ cm^2$

23) a) $x + 3 < 5 , x \in \mathbb{Z}$

$x < 5 - 3$ $x < 2$

Then the S.S. = {1 , 0 , –1 , –2, ...}

b) $2x + 1 = -9 , x \in Z$

$2x = -9 - 1$ $\frac{2x}{2} = \frac{-10}{2}$

$x = -5$ The S.S. = {–5}

24) 1) The surface area of the circle M = πr^2

$= \frac{22}{7} \times 14 \times 14 = 616\ cm^2$

2) The area of one circular sector

$= 616 \div 8 = 77\ cm^2$

25) The measure of the angle which represents

TV = $\frac{35}{100} \times 360° = 126°$

The measure of the angle which represents

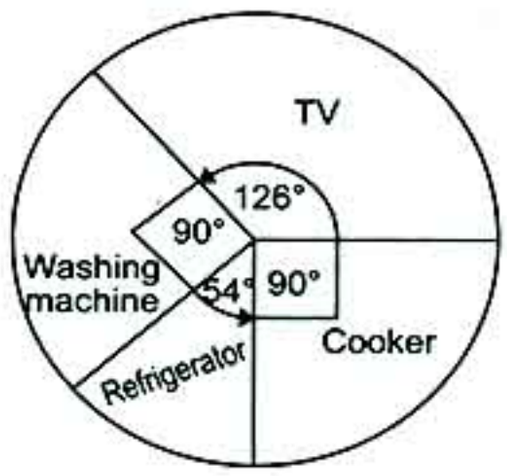
the washing machine = $\frac{25}{100} \times 360° = 90°$

The measure of the angle which represents

the refrigerator = $\frac{15}{100} \times 360° = 54°$

The measure of the angle which represents

the cooker = $\frac{25}{100} \times 360° = 90°$



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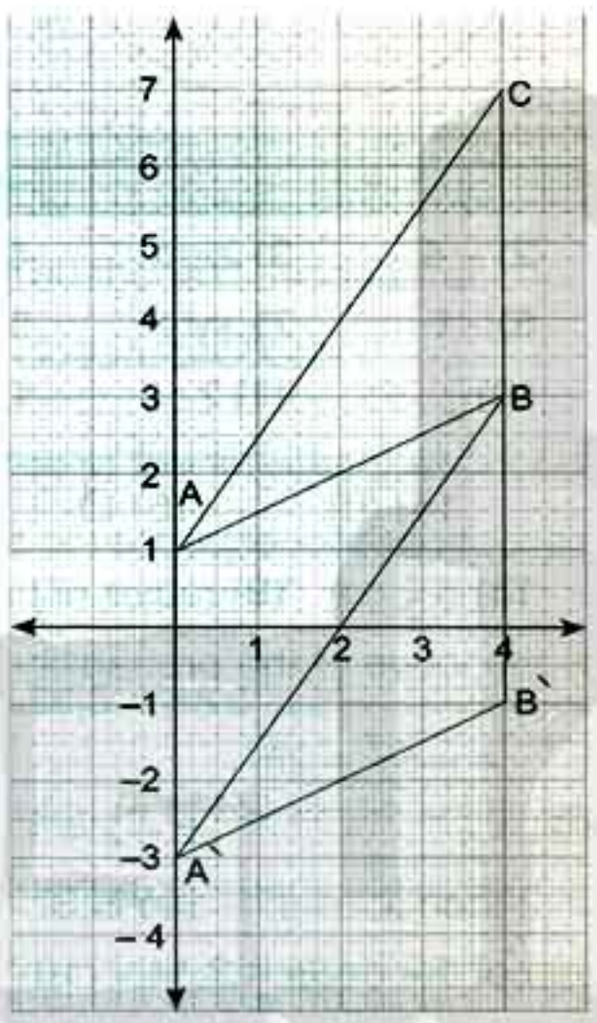
(17) Port Said - Educational Directorate - Mathematics Inspectorate

1. 1) 2r **2)** $\mathbb{Z}^-$ **3)** 6 **4)** zero
5) $\in$ **6)** 2^7 **7)** zero **8)** 3
9) 6 **10)** zero **11)** (3 , 5) **12)** – 4

2. 13) 6 **14)** 40 cm^2 **15)** 1 **16)** 360°
17) r^2 **18)** 5 **19)** N **20)** 3

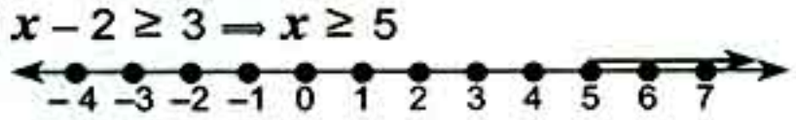
3. 21) $(4 \times 3^2 \times 3^2) - 7 \times 3 = 4 \times 81 - 21$
$= 324 - 21 = 303$

22)



1) 4
2) A` = (0 , –3), B` =(4 , –1)
C` = (4 , 3)
ΔA`B`B is the image of Δ ABC

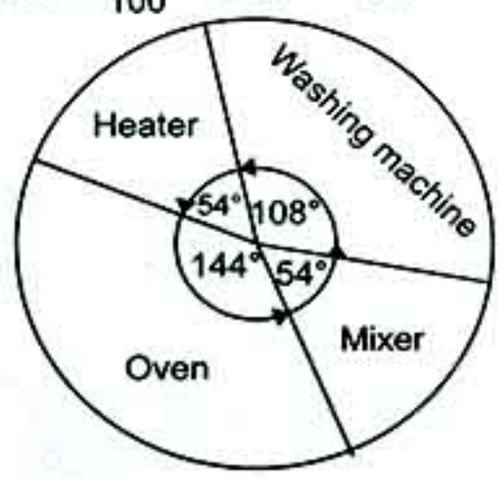
23) $x - 2 \geq 3 \Rightarrow x \geq 5$



S.S. = {5 , 6 , 7 , ...}

24) L.S.A. of the cuboid
= perimeter of base × height
= 10 × 4 × 7 = 280 cm^2

25) The measure of the angle which represents the washing machine = $\frac{30}{100} \times 360° = 108°$
The measure of the angle which represents the heater = $\frac{15}{100} \times 360° = 54°$
The measure of the angle which represents the oven = $\frac{40}{100} \times 360° = 144°$
The measure of the angle which represents the mixer = $\frac{15}{100} \times 360° = 54°$



(18) Ismailia - Directorate of Education

1. 1) $\mathbb{Z}^-$ **2)** 1 **3)** (5 , 4) **4)** 360°
5) –6 **6)** second **7)** 100 **8)** 5
9) 2 **10)** – 4 **11)** 9 π **12)** 5

2. 13) –1 **14)** $\frac{1}{2}$ **15)** 2 : 3
16) 864 **17)** 6 **18)** 1 **19)** 280
20) 616

3. 21) a) $7^{5+3-6} = 7^2 = 49$

b) 116 + 190 + (–116) = [116 + (–116)] + 190
commutative and associative property
= zero + 190 (additive identity) = 190 closure

22) $2x + 1 = -13$ $2x = -13 - 1$
$2x = -14$ $x = \frac{-14}{2} = -7$
The S.S. = {–7}

23) L.S.A. = perimeter of base × height
$= 2 \times (6 + 4) \times 8 = 160\ cm^2$
The T.S.A. = L.S.A. + area of 2 bases
$= 160 + 2\ (6 \times 4) = 160 + 48 = 208\ cm^2$

24) S = {1 , 2 , 3 , 4 , 5 , 6 , 7 , 8 , 9 , 10}

1) The probability that the drawn ball has an odd number = $\frac{5}{10} = \frac{1}{2}$

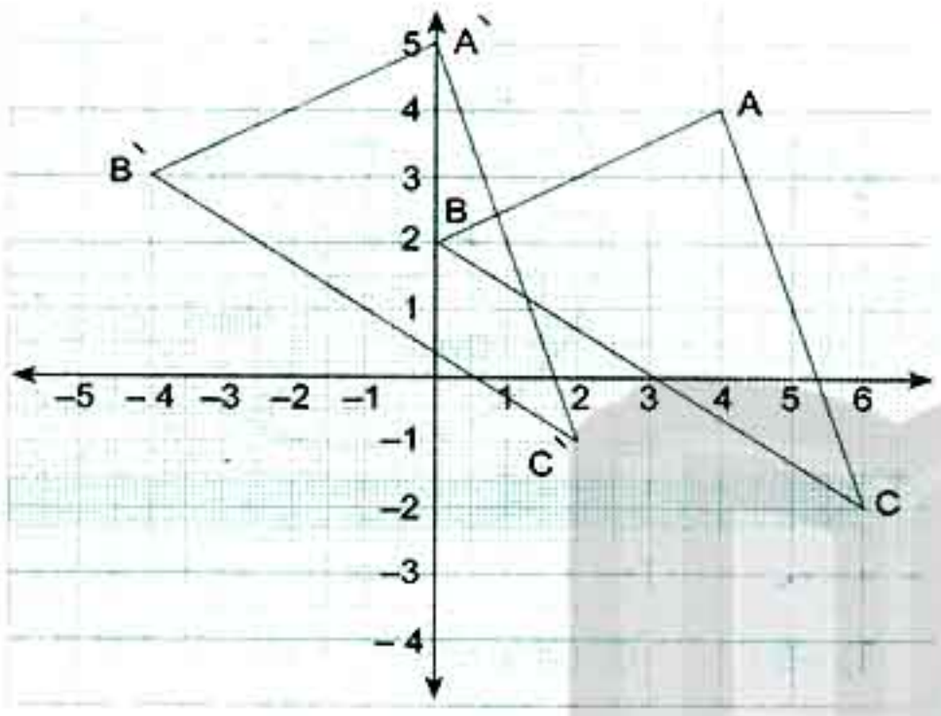
2) The probability that the drawn ball has a number divisible by 3 = $\frac{3}{10}$

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3) The probability that the drawn ball is an even prime number = $\frac{1}{10}$

4) The probability that the drawn ball has a number more than 6 = $\frac{4}{10} = \frac{2}{5}$

25) $A` = (0\ ,\ 5)$, $B` = (-4\ ,\ 3)$, $C` = (2\ ,\ -1)$



19 Suez - Maths Inspectorate

1. 1) zero **2)** ⊂ **3)** second **4)** =

5) zero **6)** 360° **7)** $\mathbb{Z}^-$ **8)** =

9) 6 **10)** 7 **11)** –20

12) (–3 , 0)

2. 13) $\mathbb{Z}^-$ 14) diameter 15) 2^5

16) – 4 **17)** height **18)** 400 cm^2

19) perimeter of the rectangle **20)** $\frac{8}{16} = \frac{1}{2}$

3. 21) (–7) + 19 + 17

= [(–7) + 17]+19

commutative and associative properties

= 10 + 19 = 29 closure.

22) $x - 2 \leq 3 \Longrightarrow x \leq 3 + 2$

$x \leq 5$ S.S. in $\mathbb{Z}$ = {5 , 4 , ... , –1 , –2 , ...}

23) The surface area of the circle = πr^2

$= \frac{22}{7} \times 7 \times 7 = 154\ cm^2$

24) L.S.A. = perimeter of base × height

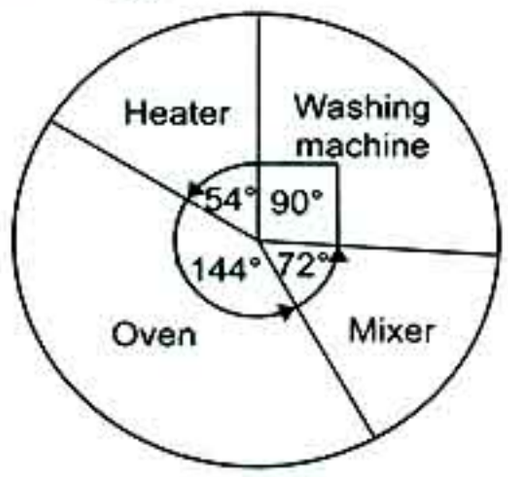
$= 10 \times 4 \times 7 = 280\ cm^2$

25) The measure of the angle which represents the washing machine = $\frac{25}{100} \times 360° = 90°$

The measure of the angle which represents the heater = $\frac{15}{100} \times 360° = 54°$

The measure of the angle that represents the oven = $\frac{40}{100} \times 360° = 144°$

The measure of the angle which represents the mixer = $\frac{20}{100} \times 360° = 72°$



20 Fayoum - Directorate of Education - Mathematics Supervision

1. 1) $\mathbb{Z}$ **2)** – 4 **3)** zero **4)** 7

5) > **6)** –1 **7)** xy **8)** (1 , 0)

9) $\frac{1}{2}$ **10)** $\frac{1}{4}$ **11)** 2 : 3 **12)** 60

2. 13) third 14) {0} 15) ∅ 16) 150

17) 7 **18)** $6\frac{2}{3}$ cm **19)** radius of the circle

20) zero ≤ the value of the probability ≤ 1

3. 21) $(-5)^{5+4-7} = (-5)^2 = 25$

22) $\frac{3}{3}(x + 2) = \frac{3}{3}$ $x + 2 = 1$

$x = 1 - 2$ then $x = -1$ the S.S. = {–1}

23) The area of the circle = $3.14 \times (10)^2 = 314\ cm^2$

24) L.S.A. = $(10 + 5) \times 2 \times 8 = 240\ cm^2$

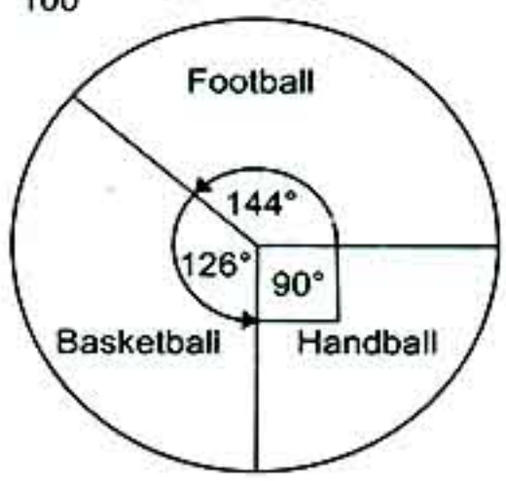
T.S.A. = L.S.A. + area of bases

$= 240 + 2 \times 10 \times 5 = 340\ cm^2$

25) The measure of the angle which represents the football = $\frac{40}{100} \times 360° = 144°$

The measure of the angle which represents basketball= $\frac{35}{100} \times 360° = 126°$

The measure of the angle which represents handball = $\frac{25}{100} \times 360° = 90°$



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21 Assuit - Administration of Distinguished Language Schools

1. **1)** ∈ **2)** 1 **3)** –1 **4)** zero
5) –2 **6)** $\frac{1}{3}$ **7)** 2^8 **8)** 5
9) $x \geq 3$ **10)** 154 **11)** 5 **12)** {3}

2. **13)** ∅ **14)** 10 **15)** 25 **16)** (5 , 4)
17) 216 **18)** 5 units **19)** second **20)** $\frac{1}{6}$

3. **21)** S.S. = {2 , 1 , 0}

22) (–116) + 190 + 116 = [(–116) + 116] + 190
commutative and associative property
= 0 + 190 the additive neutral
= 190 closure property

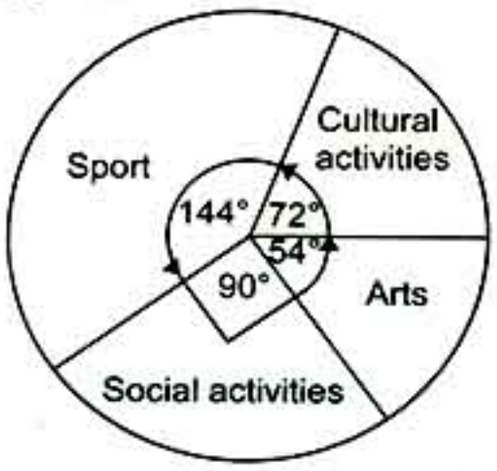
23) The area of the shaded part
= area of rectangle – area of circle
$= 12 \times 7 - \left(\frac{7}{2}\right)^2 \times \frac{22}{7}$
$= 84 - 38.5 = 45.5\ cm^2$

24) The measure of the angle which represents the cultural activities = $\frac{20}{100} \times 360° = 72°$

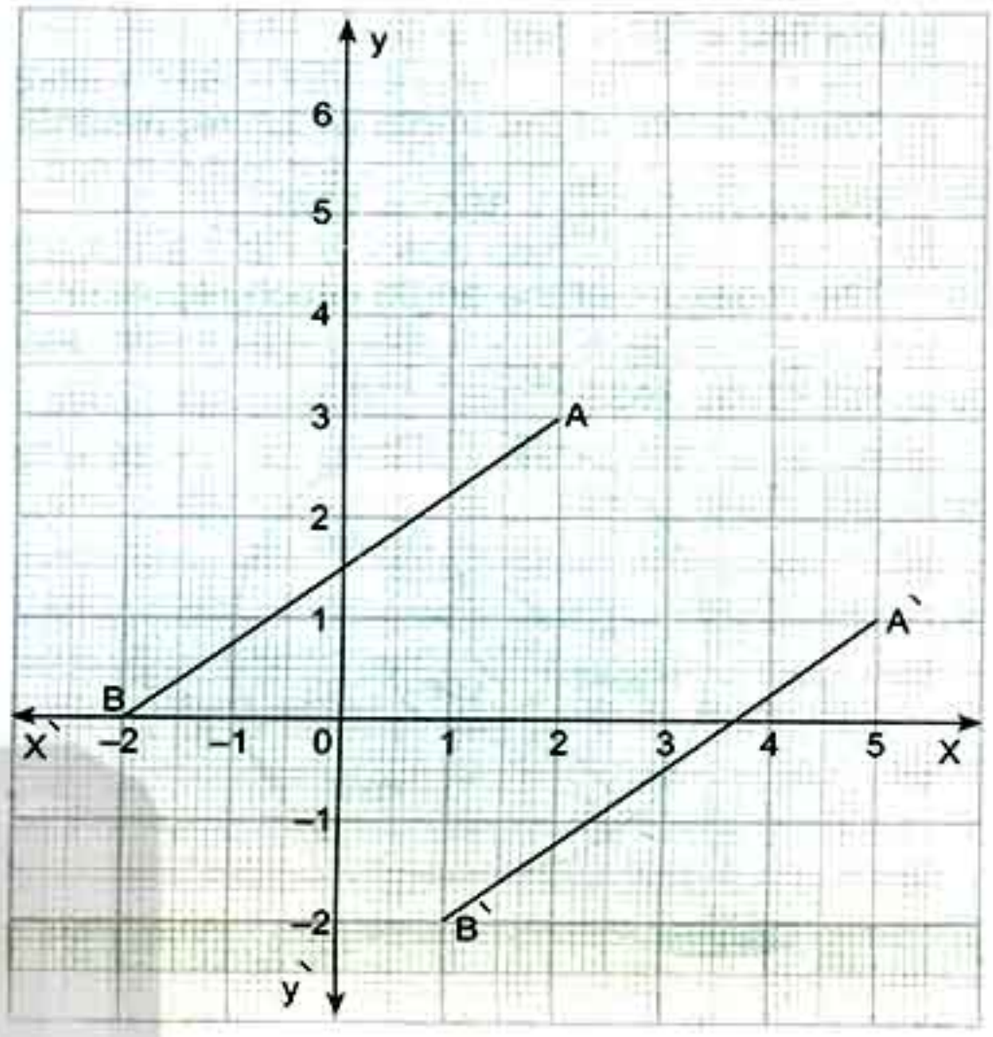
The measure of the angle which represents sport = $\frac{40}{100} \times 360° = 144°$

The measure of the angle which represents social activities = $\frac{25}{100} \times 360° = 90°$

The measure of the angle which represents arts = $\frac{15}{100} \times 360° = 54°$



25)



22 Qena - Qeft Educational Directorate

1. **1)** ∅ **2)** 30 **3)** 12 **4)** –3
5) $\overline{Z}$ **6)** 2r **7)** 6 **8)** 144
9) (0 , 3) **10)** 360° **11)** 0.5 **12)** ⊂

2. **13)** 5 **14)** 5 **15)** 2
16) 54 (117 – 17) = 54 × 100 = 5400
17) 154 cm^2 **18)** 6
19) zero , 1 **20)** ⊂

3. **21)** $2^{5-4} \times (-2)^{3-1} = 2 \times (-2)^2 = 2 \times 4 = 8$

22) $2x + 9 \leq 1$
$2x \leq 1 - 9 \Rightarrow 2x \leq -8$
then $x \leq -4$
1) S.S. = {– 4 , –5 , –6 , ...} $x \in Z$
2) The S.S. in N = ∅

23) **1)** L.S.A.= 2 × (6 + 4) × 8 = 20 × 8 = 160 cm^2
2) T.S.A. = 160 + 2 × 6 × 4 = 160 + 48 = 208 cm^2

24) **1)** The probability of drawing a white ball
$= \frac{8}{20} = \frac{2}{5}$
2) The probability of drawing red ball
$= \frac{12}{20} = \frac{3}{5}$

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25) The measure of the angle which represents

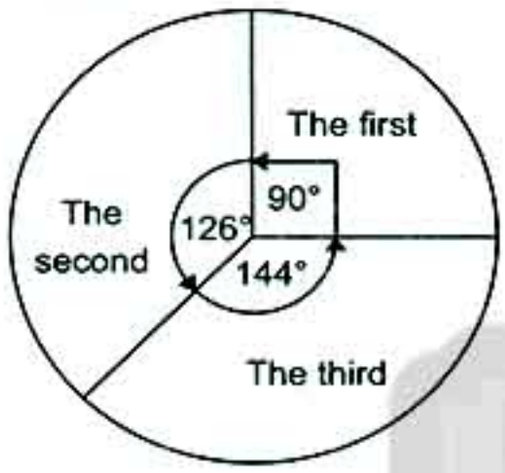
the first = $\frac{25}{100} \times 360° = 90°$

The measure of the angle which represents

the second = $\frac{35}{100} \times 360° = 126°$

The measure of the angle which represents

the third = $\frac{40}{100} \times 360° = 144°$



23 Sohage - Educational Directorate City Private Schools

1. 1) ∉	**2)** $\frac{1}{2}$	**3)** 5	**4)** zero
5) 54	**6)** (5 , 3)	**7)** third	**8)** zero
9) Z^+	**10)** 1	**11)** 154	**12)** $\frac{1}{6}$
2. 13) $\frac{1}{2}$	**14)** zero	**15)** 36	**16)** 4
17) 157 cm^2		**18)** (–1 , –2 , –3 , – 4)	
19) N	**20)** –1		

3. 21) $3x + 1 > -5$ $\quad 3x > -6 \Rightarrow x > -2$

S.S. = {–1 , 0 , 1 , 2 , ...}

22) The area of the shaded part

= area of square – area of circle

$= 10 \times 10 - \frac{22}{7} \times 5 \times 5$

$= 100 - 78\ \frac{4}{7} = 21\ \frac{3}{7}\ cm^2$

23) L.S.A. = perimeter of base × height

$= (16 + 7) \times 2 \times 19 = 46 \times 19$

$= 874\ cm^2$

24) $(-11) \times [5 + (-3)] = (-11) \times 5 + (-11) \times (-3)$

$= -55 + 33 = -22$

25) The measure of the angle that represents

football = $\frac{40}{100} \times 360° = 144°$

The measure of the angle that represents

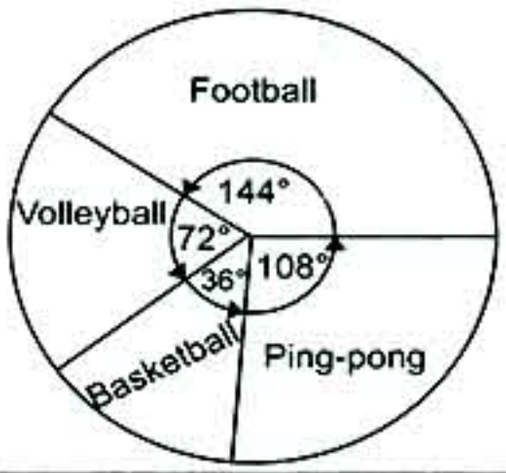
volleyball = $\frac{20}{100} \times 360° = 72°$

The measure of the angle that represents

basketball = $\frac{10}{100} \times 360° = 36°$

The measure of the angle that represents

ping pong = $\frac{30}{100} \times 360° = 108°$



24 Luxor - Educational Directorate - El-Salam Language School

1. 1) $\frac{1}{2}$	**2)** 2	**3)** (5 , 4)	**4)** second
5) 0	**6)** 40	**7)** 3	**8)** 2
9) <	**10)** –7	**11)** –2	**12)** 360
2. 13) ∅	**14)** 4	**15)** zero	**16)** 3
17) height	**18)** 4	**19)** (2 , 2)	**20)** πr^2

3. 21) $2^{3+4-7} = 2^0 = 1$

22) $2x + 1 \geq 5$ in Z

$2x \geq 5 - 1$ $\quad 2x \geq 4 \Rightarrow x \geq 2$

S.S. = {2 , 3 , 4 , ...}

23) The area of the circle = $\pi r^2 = \frac{22}{7} \times 7 \times 7 = 154\ cm^2$

24) The measure of the angle which represents

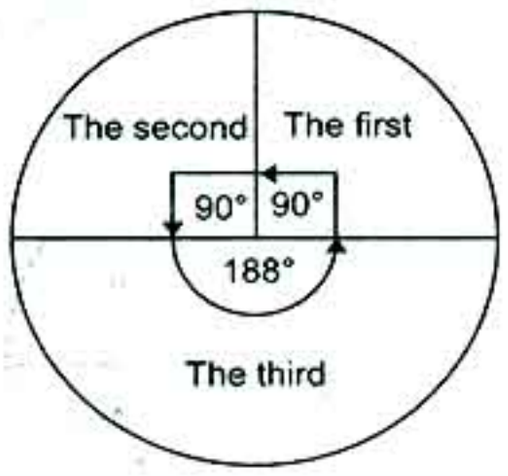
the first = $\frac{25}{100} \times 360° = 90°$

The measure of the angle which represents

the second = $\frac{25}{100} \times 360° = 90°$

The measure of the angle which represents

the third = $\frac{50}{100} \times 360° = 180°$



Pre-exam Final Revision

1. 1) Z^-	**2)** –1	**3)** –1	**4)** –12
5) $(-3)^3$	**6)** 50	**7)** A = {–3}	**8)** ℤ

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9) ∅ **10)** N **11)** (–5, –1) **12)** 2

13) Zero **14)** ∉ **15)** Zero

16) 90° **17)** N – {0}

From 18 to 28 are left to the student.

2. 1) 2 (L + w) × h

2) It is an experiment in which we can determine all its possible outcomes before carrying it out, but we can't predict certainly which of these outcomes will occur.

3) 9 (4 + (–3)) = 9 × 4 + 9 × (–3) = 9

4) 7^3

5) 18, each number is more than its predecessor by 4.

6) 5 cm. **7)** 6 **8)** Zero

9) 78.5 **10)** (1, 3)

From 11 to 27 are left to the student.

3. –4 < 2 x ≤ 2, then –2 < x ≤ 1. S.S. = {–1, 0, 1}



4. a) 2 x ≥ 8 (÷2) , then x ≥ 4 S.S. = {4, 5, 6, 7, ...}

b) 3 x = 6 x = 2 S.S. = {2}

5. The **area of the squared shaped cardboard**

= 80 × 80 = 6400 cm^2

The total area of the cuboid

= (L + W) × 2 × h + 2 × L × W

= [(40 + 20) × 2 × 30] + [2 × 40 × 20] = 5200 cm^2

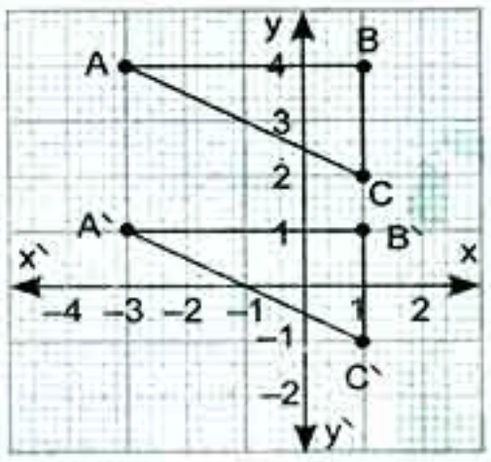
The piece of cardboard is enough to design the cuboid.

6. AB = 4 length units, BC = 2 length units

A` = (–3, 1)

B` = (1, 1)

C` = (1, –1)



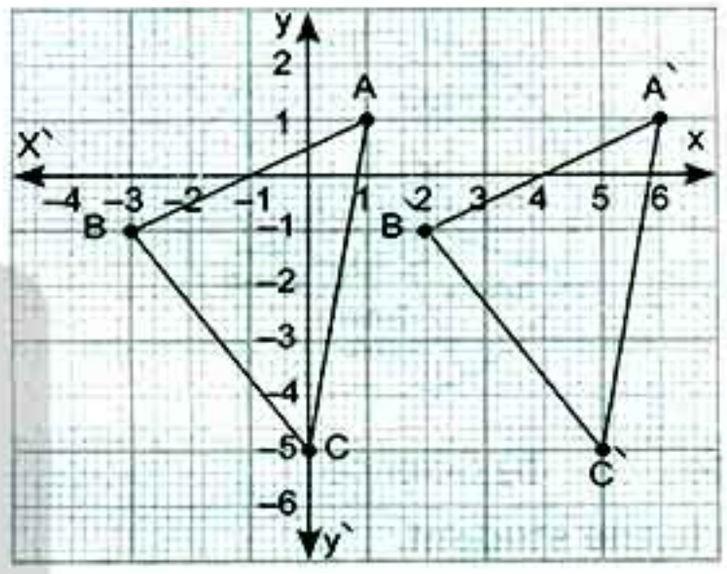
7. Side = 108 ÷ 12 = 9 cm

L.S.A.= 9 × 9 × 4 = 324 cm^2

T.S.A.= 9 × 9 × 6 = 486 cm^2

The ratio = 324 : 486 = 2 : 3 or $\frac{2}{3}$

8. A` = (6, 1) B` = (2, –1) C` = (5, –5)



9. r^2 = 2826 ÷ 3.14 = 900 ⟶ r = 30 cm

Circumference = 2π r = 2 (3.14) × 30 = 188.4 cm.

10. The measure of the angle of the sector that represents the production of TV sets

$= \frac{30 \times 360}{100} = 108°$

The measure of the angle of the sector that represents the washing machine = $\frac{25}{100} \times 360°$

$= 90°$

The measure that represents the refrigerator

$= \frac{15 \times 360}{100} = 54°$

and the measure of the angle which represents the cooker

$= \frac{30 \times 360}{100} = 108°$



11. The measure of the angle of the sector that represents Arabic = $\frac{9}{40} \times 360° = 81°$

The measure of the angle of the sector that represents English = $\frac{6}{40} \times 360° = 54°$

The measure of the angle of the sector that represents maths = $\frac{7}{40} \times 360° = 63°$

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The measure of the angle of the sector

that represents science = $\frac{5}{40} \times 360° = 45°$

The measure of the angle of the sector

that represents social studies = $\frac{6}{40} \times 360° = 54°$

The measure of the angle of the sector

that represents other subjects = $\frac{7}{40} \times 360° = 63°$



a) Arabic **b)** Science

c) Left to the student.

12. S = {w_1, w_2, w_3, w_4, w_5, r_1, r_2, r_3, r_4, r_5, r_6, r_7, r_8, r_9}

a) $\frac{5}{14}$ **b)** $\frac{9}{14}$ **c)** Zero.

13. S = {12, 13, 21, 23, 31, 32}

a) The probability of getting an odd prime number = $\frac{3}{6} = \frac{1}{2}$

b) The probability of getting an even number = $\frac{2}{6} = \frac{1}{3}$

14. a) A = {2, 4, 6, 8, 10, 12, 14, 16, 18, 20}.

P (A) = 1

b) P (B) = 1 P (C) = $\frac{3}{10}$

15. a) $\frac{4}{6} = \frac{2}{3}$ **b)** $\frac{4}{6} = \frac{2}{3}$

16. a) $\frac{4}{10} = \frac{2}{5}$ **b)** $\frac{6}{10} = \frac{3}{5}$ c) Zero

17. a) $\frac{4}{10} = \frac{2}{5}$ **b)** $\frac{5}{10} = \frac{1}{2}$ **c)** $\frac{2}{10} = \frac{1}{5}$

RaNia SaYed

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